"THE WEEKEND EFFECT ON THE JOHANNESBURG STOCK EXCHANGE"

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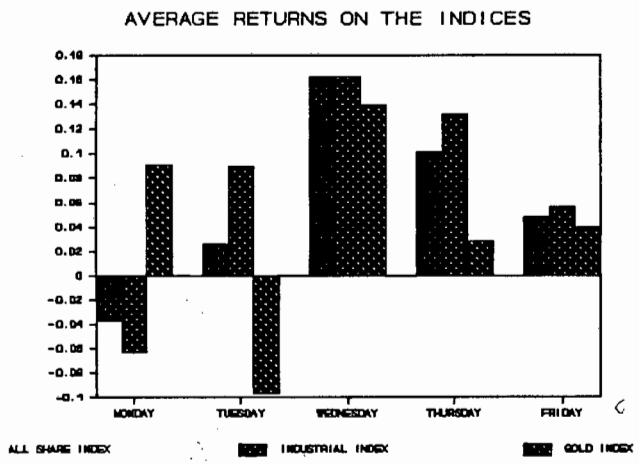

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I certify that, except as noted above, this work is entirely my own and it has not been submitted as a dissertation for a degree at any other university.

PETER NASH

ABSTRACT

The study of intraweek share return patterns has received considerable attention in the field of international research. This research has shown that share returns tend to be higher than average on the last trading day of the week and lower than average on the first. This anomaly has come to be known as the Weekend Effect.

Explanations proffered for this phenomenon have failed adequately to justify the pattern of returns across the weekdays. These explanations include settlement period delays, dividend effects, measurement error in share prices, institutional features and the tendency for firms to release unfavourable information over the weekend.

This study investigates day of the week effects on returns of the All Share Index, Industrial Index and Gold Index on the Johannesburg Stock Exchange. The results indicate that the pattern of returns on the All Share Index has not altered significantly since Bhana's (1985) study. An above average Wednesday return and negative Monday return are still apparent. However, Bhana's study failed to examine returns on the Industrial and Gold Index. This study shows that the Industrial Index displays the same return pattern as the All Share Index. However, the Gold Index displays atypical behaviour with a negative Tuesday return.

The study improves upon Bhana's research by exploring for explanations to the anomalous behaviour. This is achieved by reproducing adjustments made to returns in international research papers. Returns are adjusted for uneven settlement delays and dividend effects. When settlement effects and dividend effects are adjusted for simultaneously, it is found that the All Share and Gold Indices display no significant day of the week effect. Settlement delays explain the Midweek Effect on the All Share Index, while a combination of the settlement effect and the dividend effect explain the negative Monday return. However, the Midweek Effect remains an unexplained anomaly on the Industrial Index.

The study also shows that returns are generated in trading time for the All Share index, while neither the trading nor calendar time hypotheses provide an adequate explanation of the return generating process on the Industrial Index. However, both the calendar and trading time models are acceptable for the Gold Index. Thus it is clear that the return generating process is not the same for the different indices.

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CHAPTER ONE

INTRODUCTION

The purpose of this paper is to determine if the equity indices on the Johannesburg Stock Exchange exhibit similar empirical anomalies to those found on other international stock exchanges. These anomalies relate to non-random movements in share prices. The non-random movements, which have been widely documented and are reviewed in Chapter Two, indicate that the distribution of share prices is not the same for all days of the week. This thesis examines the distribution of share prices on the different weekdays by studying the closing values of the three equities indices[1]. This study, like most other studies in this field, considers the day-to-day returns[2] on the indices. Thus the distribution of share prices across the weekdays is empirically investigated by analyzing daily returns on the share or equity indices.

These share market anomalies relate to the uneven distribution of day-to-day index returns across the weekdays. The most common anomaly noted on international markets is that Mondays exhibit a significant negative return, while Fridays exhibit significant positive returns when compared to other weekdays. This has come to be known as the "Weekend Effect". These observations are crucial since they appear to contradict the Efficient Market Theory.

> **"The Efficient Market Theory holds that market prices fully and instantaneously reflect all available information. In this sense share prices are said to be 'correct' and provide accurate signals for resource allocation."** (Firth, 1986)

Informational efficiency of share markets implies that all available information is fully and instantaneously reflected in the share price. Thus there is no delay between the time when information reaches the market, and is incorporated in the share price. Bad news has an immediate negative impact on the share price, while good news immediately causes the share price to rise. Consequently, it is not possible to **consistently** earn

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[1]The three equity indices that are studied are the All share, Industrial and Gold indices.

[2]"Day-to-day returns on the indices" is defined as the difference between the closing value of the index on day t less the closing value of the index on the preceding day (t-1) divided by the preceding day's (t-1) closing value, multiplied by one hundred. For more in depth discussion, see equation {1} in Chapter Three.

excess returns, except by **chance**. It is important to note the words "consistently" and "chance" - it is possible to earn excess returns on the share market, but according to the efficient market theory this would be entirely due to chance.

In an informationally efficient market, share prices change on the arrival of new information. However, if new information arrives randomly, share prices will be unpredictable. Since share prices are unpredictable, they behave as if generated by a random process. The random manner in which share prices are generated implies that it is impossible to derive a mechanical investment strategy that consistently outperforms the market. "The almost unanimous conclusion from academic research is that no mechanical investment strategies have been found which consistently earn excess returns after allowing for transaction costs that the strategy incurs." (Firth, 1986) In the case of the share market, these transaction costs relate to brokerage fees and security taxes.

Many market participants claim that they receive objective buy and sell indicators which yield excess returns. In order for a trading strategy to violate the efficient market hypothesis, it has to earn abnormal returns on a consistent basis. Certain investors claim they have such a strategy or trading rule. For obvious reasons, they are usually not prepared to divulge such information, and consequently such claims cannot be substantiated. (One obvious method of testing such a claim would be to analyze the returns of the investor, and see whether the investor consistently earned excess returns.)

1.1 Seasonalities

A seasonality is a time period during which asset returns are above or below average returns on a consistent basis. Since this time period repeats itself, it is predictable. In an efficient share market, one would expect no recurring pattern of returns to exist. Should such a pattern of returns exist, it would be possible to invest at times when prices are expected to be low and sell when prices are high. These investors would be able to consistently earn excess returns, after taking transaction costs into account. In an efficient market the actions of such investors would eventually lead to the disappearance of these excess returns. This would be achieved since information about the seasonality and its excess returns would become available to other investors. Other investors would follow the same pattern of buying when prices are low and selling when prices are high, in turn causing prices to rise with an increase in demand for the share at the start of the seasonality, and to fall when investors sell at the end. Any excess returns would disappear in this arbitrage process.

The existence of seasonalities may contradict the efficient market theory. However, it is possible that such seasonalities are due to the behaviour of rational investors in the market place. Day of the week effects may be the result of the actions of rational investors - a logical reason may be in existence to

cause the returns of a particular time period to be consistently above average. For example, share prices may move based on the last day to register for a dividend. If this were not taken into account in the behaviour of share prices, it would distort the empirical results and create a day of the week effect. However, if no logical or rational reason for an inconsistency exists, then it is an anomaly and is by definition a contradiction of the theory.

Studies on the pattern of share returns across weekdays is part of the study of seasonalities in general. However, it is necessary to briefly explain other seasonal effects, so as to obtain an understanding of where this thesis fits into the field of seasonalities. Many examples of seasonalities exist. Studies indicating that share returns are traditionally higher in the month of January relative to other months of the year have come to be known as the January Effect (Maberly E. & Maris B., 1991). Other studies have observed share returns being consistently high on the days preceding public holidays as opposed to the returns generated on the other days of the week (Ariel, 1986. Fields, 1934). This has come to be known as the Public Holiday Effect. The Weekend Effect is due to the observation of returns (not only on the share market) being continually high on Fridays and low on Mondays. (The terms "low" and "high" are clearly in relation to the average returns of the particular financial instrument being studied.) The Monday Effect is due to the observation of negative returns on Mondays. When the negative Monday return is combined with an above average positive Friday return, it has been termed the Weekend Effect. Both the Monday Effect and the Weekend Effect form part of the study of day of the week effects on share returns.

1.2 The Generation of Share Returns

Share returns (for the moment ignoring return due to dividends) are the result of changes in the prices of shares over a period of time. In fact a return is, by definition, linked to a specific time period. It is not possible to speak of return without the notion of time. Thus one needs to consider how returns are generated and measured over time. Do non-trading days (e.g. weekends and holidays) contribute towards a share's return, or are returns generated solely during trading[3] time periods? In an efficient market where share prices are generated in a random manner, one expects the distribution of daily returns to be generated by one of two processes. The first possibility is that returns are generated solely during times that the market is open for trade. This has been termed the trading time hypothesis (Clark, 1975). The other possibility is that returns are generated irrespective of whether the market is open or closed. This would imply that returns are generated over calender time, and has been termed the calendar time hypothesis (Fama, 1965).

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[3]Trading time period relates to the time that the market is open for trade. The Johannesburg Stock Exchange is open for trade on Monday to Friday from 09H30 to 16H00.

Researchers investigating the generation of share returns have generally assumed that the distribution of asset returns follows one of the above models. Most researchers support the trading time model, assuming that the distribution of share returns is identical for all days that the market is open (Hess,1981). However, "in recent years it has been found that the stock market returns in a number of countries (e.g. UK, USA, Canada, Japan, Finland, and Australia) are not completely random" (Board et al.,1988). The most common form of this non-randomness is that returns tend to be significantly higher on a Friday, and lower (sometimes even negative) on a Monday. Several studies have been conducted on these intraweek trading patterns, which has come to be known as the "Weekend Effect".

1.3 Major results of previous studies

The first paper to document an intraweek trading pattern was written by Fields (1931). He noted that, quite contrary to popular belief, share prices tended to rise prior to a holiday. This was the first formal evidence that share returns might not be the same on all days of the week.

Cross (1973) examined the distribution of share price changes on Fridays and Mondays by examining changes in the Standard and Poors Composite Stock Index. He documented a relationship between Friday and Monday share prices that indicated that the movements in share prices were non-random. His studies showed that the Standard and Poors Composite Stock Index performed better on Fridays than Mondays, both in terms of mean percentage change[4] and the percentage of times the index advanced[5] in every year of the eighteen year study period. It was this non-random movement in share prices on Mondays and Fridays that came to be known as the "Weekend Effect".

French (1980) examined the process of generating share returns. He tested the two alternative hypotheses - the trading time hypothesis and the calendar time hypothesis. Both of these are discussed in more depth in Chapter Two. His empirical results showed significant negative Monday returns. These results contradicted both hypotheses, since the trading time hypothesis postulates that returns should not be significantly different for any of the weekdays and the calendar time hypothesis submits that Monday's return should be three times as large as any other weekday.

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[4]Cross' mean percentage change related to the average return (as given in formulae {1} in Chapter Three) for that weekday. His article gives no formulae, but his results indicate that Friday's have a mean percentage change of +0.12% while Monday's have a mean percentage change of -0.18%.

[5]Cross defined an advance on the index as an increase in the value of the Standard and Poors Composite Stock Index when compared to the preceding day. The index advanced on 62% of the Fridays, and only 39,5% of the Mondays.

At this point researchers tried to find an explanation to this anomalous behaviour in share returns. The two most important contributions related to settlement delays and dividend effects[6]. Lakonishok and Levi (1982) adjusted daily returns for the effects of settlement delays. The results provided a partial explanation (about 20%) to the anomalous observation of different daily returns. Board and Sutcliffe (1988) examined whether the anomalous behaviour could be explained by the effects of dividends. Their results indicated that dividends did influence daily returns, but not to the extent of the observed anomaly.

1.4 The Contribution of this Study

Only one published study on the Weekend Effect on the JSE exists (Bhana, 1985). The contents of this study are dealt with in depth in Chapter Two. However, one of Bhana's **recommendations** was "that follow-up studies on the effect of day of the week on the JSE should be undertaken as more computer-based information becomes available." This study proposes to fill this gap. Bhana's recommendation for a later study stems from the fact that his conclusions are based on only five years of daily data. International studies typically include at least twelve and a half years of data. This study gives us results over a ten year period and should serve to confirm or dispute the findings of Bhana.

A unique aspect of this study's data is that it also includes time over which the futures market was introduced to the South African market. Thus the data is subdivided into two time periods - pre- and post-futures market introduction. In this manner it is possible to identify whether the **futures market** has had any influence on daily return patterns on the JSE.

The study analyses the JSE's All Share Index, Industrial Index and the Gold Index. At the time of printing, the author is unaware of any study that has performed an analysis of the three **different Indices**. The Johannesburg Stock Exchange differs from other international share markets due to the large influence of the gold shares on the All Share Index. It is possible that the day of the week effect may be distorted on particularly the Gold Index and to a lessor extent the All Share Index, due to the influence of gold shares.

Bhana's study did not attempt to explain any **possible reasons** for the Weekend Effect. Numerous explanations have been offered in

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[6]Settlement delays refer to the time delay between purchase date and settlement date. Daily returns need to be adjusted for the interest effects of such settlement delays, since the settlement period varies according to the day on which purchase occurs. Dividend effects refer to the fact that share prices will adjust downwards on the day after the last day to register(LDR). If the LDR consistently falls on any particular weekday, it will need to be adjusted for. Both of these adjustments are comprehensively explained in Chapter Two and Three.

the studies of international share markets. None of these explanations have totally rationalised[7] the Weekend Effect. However, these explanations must be taken into account in any study on the day of the week seasonality. This study performs various manipulations[8] on the data so as to adjust for the latest possible explanations of differing returns for different days of the week.

The Weekend Effect represents an anomaly which provides evidence contradicting the Efficient Market Theory. In the words of Board and Sutcliffe (1988) :

> "The non-randomness in stock returns apparently **contradicts** the widely accepted view that stock markets are at least weakly efficient[9] for frequently traded shares. This challenges one of the central results of finance theory, and has therefore attracted considerable attention."

As such it is important, since other studies[10] on share markets have been based on the belief that returns are uninfluenced by the day of the week (Lakonishok and Levi, 1982). Seasonality studies on the share markets have shown these assumptions to be incorrect, and thus future studies on share markets must take the results of the "Weekend Effect" into account. (i.e. To base theories upon assumptions that are at odds with the economic reality, must lead to invalid theories. Thus any results and conclusions based on an incorrect assumption must call to question the validity of those findings.)

If the share market is weakly inefficient, it may be possible to find an economically viable **trading strategy** based on day of the

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[7]International studies have found partial explanations to weekend anomaly. However, this is where these explanations stop. They only explain **part** of the negative Monday and high Friday return. Consequently, the explanations fail to totally rationalise the anomalous Weekend Effect.

[8]For example, adjusting returns for the effects of uneven settlement delays and LDR's which do not fall randomly across the weekdays (i.e. dividend effects).

[9]The Efficient Market Theory is divided into three levels, weak form, semi-strong form and strong form efficiency, based on the type of information that is available to the potential investor. Weak form efficiency implies that no excess returns can be earned by utilising historical information regarding share prices and financial data. The three levels to the Efficient Market Theory are discussed in depth in Chapter Two.

[10]These "other studies" are NOT on seasonalities, but ARE on other aspects of the share market. One of the assumptions of these other studies has been that returns are uninfluenced by the day of the week. Seasonality studies on the share market has shown this assumption to be invalid.

week share return patterns. On international markets, such a strategy would imply buying shares on a Monday and selling on a Friday. Previous studies indicate that this trading strategy would be unprofitable as a trading rule due to transaction costs (e.g. brokerage fees, security taxes etc.). However, this may not be the case in the South African share market. Even if transaction costs do make an active trading rule based on day of the week effects impractical, this information would still be valuable to an investor, who wishes to invest in shares for a period of at least one week. This would lead to a strategy of delaying purchases, that would have been made anyway until a Monday, and selling on a Friday.

Another contribution made by this study arises due to the introduction of Index funds. (Index funds are similar to unit trusts, except that an index fund is "passively" managed needing only to replicate, or track, the underlying indices without the need for research-based and active selection of undervalued shares.) Clearly, index funds will be extremely interested in the performance of the indices over the days of the week. Such a fund could gain tremendous financial advantage by merely delaying purchases to days traditionally associated with lower prices (i.e. Mondays) and selling on traditionally high price days (i.e. Fridays). It should be noted that such actions would eventually arbitrage away the potential advantage of purchasing or selling on any particular weekday, and no further day of the week pattern would be evidenced.

Previous studies have adjusted for the effects of settlement delays by assuming interest rates to be equal across all weekdays. This is a convenient assumption, but it may be that interest rates also exhibit day of the week effects like the share market. This assumption would distort the adjustment for settlement delays. Consequently, this study proposes to adjust for settlement delays by using the **daily interest rates.** In this manner, any possible day of the week effects in interest rates do not create a bias in the adjustment for settlement effects.

1.5 Brief outline of this thesis

Chapter Two contains a chronological review of the more important literature relating to share market seasonalities. The weak, semi-strong and strong forms of the Efficient Market Theory are discussed. In addition, literature relating to the trading and calendar time hypotheses is presented. Potential explanations of the Weekend Effect are offered, and discussion is made as to how they relate to the Johannesburg Stock Exchange. Additional comments are added so as to explain how problems encountered in other studies are dealt with in this thesis.

As this study revolves around the JSE share indices, it will require a brief outline on the history of the indices, their construction and administration. This is presented in Chapter Three, along with a discussion of the data used.

Chapter Three also contains a review of the econometric models

to be used in this study. This chapter discusses the statistical formulae, and an explanation of what these statistical models represent and hope to achieve.

Chapter Four analyses the empirical results obtained from the performance of the tests described in Chapter Three. The results are presented in both a tabular and graphical format. An analysis of these results is also made in this chapter.

Chapter Five presents a resume' of this study. It includes a summary of the significant results, and a discussion of the contributions to research made by this study. Inevitably there are areas that could not be adequately covered due to a shortage of data availability and limitations of scope of this study. Thus, suggestions as to where future research can improve and enhance on this study are discussed.

CHAPTER TWO

LITERATURE REVIEW

This chapter contains a literature review of research relevant to this thesis. Comments have been made on international studies, to explain how various problems encountered in these studies are addressed in the South African scenario.

The chapter begins with a discussion of the efficient market hypothesis. The efficient market hypothesis represents one of the central results of finance theory (Board and Sutcliffe, 1988). However, the various studies of research in the field of intraweek share returns, reveal an empirical anomaly that appears to contradict the efficient market hypothesis. This empirical evidence relates to abnormally high returns on Fridays and negative returns on Mondays. Various authors have tried to explain the observed anomaly with different theories. None of these appear to fully explain the observed anomaly, since after making adjustments for the theoretical explanations, a day of the week effect still exists. Researchers have thus investigated other international markets - including Australia, Japan and Canada, to determine if the empirical anomaly is limited to U.S. and U.K. Although the evidence suggests that the anomaly is not limited to western markets, the pattern of the anomaly does change when one looks at other international markets. Chapter Two concludes with a summary of the more important concepts covered in this chapter.

2.1 The Efficient Market Hypothesis

The efficient market theory holds that share prices fully and instantaneously reflect all available information, including the risks involved in the investment (Ross, Westerfield and Jordan, 1993). Thus it is not possible to consistently earn an excess return[1]. While unexpected events may lead to excess returns if the investor is lucky, the expected return may not be abnormal in an efficient market (Philpott, 1993). The theory has been divided into three levels of efficiency based upon the type of information that is available to potential investors (Fama, 1970):

(a) Weak-form efficiency implies that no excess returns can be earned by utilising historical information (i.e. past share prices, trading volumes etc.) regarding share prices and financial data. The theory holds that share prices follow a random walk. "This implies that price changes are independent of each other, making it impossible to predict

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[1]A return higher than required by the risk of the investment.

a future price based on a series of past prices" (Uliana, Correia and Wormald, 1987). Thus all share market information, from past share prices, volumes traded etc., is already reflected in the share price and it is not possible to earn excess returns from technical analysis[2] (Philpott, 1993). This study is based on an analysis of the closing values of share indices. The data is publically available and represents an historical picture of share prices. As such, the study will be investigating whether the Johannesburg Stock Exchange is at least weakly efficient.

(b) Semi-strong form efficiency holds that share prices immediately adjust to all new publicly available information and that the current share price is the best indicator of the risk-return relationship of a share. Consequently it is not possible to outperform the market by trading on this new information. This implies that it is not possible to consistently earn excess returns through fundamental analysis[3] (Uliana, Correia and Wormald, 1987).

(c) Strong form efficiency implies that share prices reflect all publically[4] and privately available information and thus it is not possible to consistently earn excess returns. (This means that it is impossible to earn excess returns even if you have advance knowledge of information - Insider Trading. However, this seems unlikely to be true when you consider the number of cases being investigated by regulatory authorities, and the enormous profits that these 'insiders' derive. ie Ivan Boesky.)

If share markets are weak-form efficient, it would be impossible to exploit historical information to consistently earn excess

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[2]Technical analysis or charting is the process where future share prices are predicted using graphs depicting the history of the share price, trading volumes etc. The updated version of the efficient market hypothesis recognises the costs of gathering such information, and states that it is not possible to earn an excess return after taking into account the costs of gathering such information.

[3]Fundamental analysis is the study of all publically available information (i.e. financial statements, prospects for the industry etc.) in the hope of discovering an undervalued share that will consistently yield the investor excess returns.

[4]The most stringent definition of semi-strong and strong form efficiency would contend that only insider information differentiates between the two forms, being included in the later form of efficiency. However, a broader definition would regard proprietary information, obtained from highly sophisticated analysis, as not being publically available, and thus included only in the strong form of market efficiency.

returns. This implies that price dependencies[5] cannot be exploited to derive any trading rules which consistently yield returns that are excessive in relation to the investment's risk.

> **"The non-randomness in stock returns apparently contradicts the widely accepted view that stock markets are at least weakly efficient for frequently traded shares. This challenges one of the central results of finance theory, and has therefore attracted considerable attention." (Board et al.,1988)**

"The existence of seasonalities in stock markets represents an anomaly that financial economists are still seeking to explain" (Yadev & Pope, 1991). This paper proposes to establish whether such an anomaly exists on the Johannesburg Stock Exchange. If such an anomaly is found to exist, the paper will investigate possible explanations to the anomaly.

The seasonality anomaly has lead to a number of international studies and a limited number of South African studies[6]. A review of these studies is presented below.

2.2 Seasonalities

As discussed in Chapter One, a seasonality is a time period during which returns are above or below average returns on a consistent basis. An example of a seasonality is the January Effect, where returns are historically above average when compared to the other months of the year. Bradfield (1990) produced an article about the January Effect on the Johannesburg Stock Exchange (JSE). Since the Weekend Effect and the January Effect are both studies of seasonalities, a brief review of his findings is given.

Bradfield found that the JSE has a significant **December** Effect (in contrast to the more commonly observed January effect). His explanation for the December seasonal is based on the volatility of shares over this month. In South Africa, December is includes a holiday period during which there is very little trading. The reduced trading activity results in less volatile share returns. Bradfield concludes "that the significant seasonal effect in December is more likely to be a result of relatively less

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[5]Dependencies relate to a repetitive pattern in share prices, based on the history of the share price.

[6]There has only been one study of the Weekend Effect on the Johannesburg Stock Exchange (Bhana, 1985), but there have been other seasonality studies, such as the January Effect, which is explained later in this chapter. In addition there have been seasonality studies on other South African markets, for example capital and money market instruments.

substantial volatility than substantial return in December[7] ." On the U.S. markets Lakonishok and Smidt (1984) find a strong year-end rally when looking at share returns around Christmas and New Year's Eve. They conclude that the year-end rally may be in anticipation of good results due to "window dressing" by financial institutions whose financial year ends on 31 December.

It may be that the December rally, documented by Bradfield, is due, in part, to a disproportionate number of companies year-ends falling on 31 December. In a study conducted by Lampbrechts (1988), he noted that 96% of companies have their year-end in either December, February, March, June or September. A large number of these companies may be "window dressing"[8] for the year-end. The disproportionately large number of year-ends falling on 31 December may cause share prices to rise in anticipation of good results.[9]

This study is particularly timely, due to the fact that it is being conducted just subsequent to Bhana's (1993) study of Public Holiday share price behaviour on the Johannesburg Stock Exchange. Consequently, this study's results coincide with Bhana's results regarding this holiday effect on the JSE.

Bhana (1993) evaluates the impact of public holidays on the returns of companies listed on the JSE from 1975 to 1990. The holiday effect has been observed on all the major stock exchanges of the world, and is merely one of the many possible seasonalities. Bhana states "The holiday effect is intimately tied to the Weekend Effect." Once again this leads to the question of whether the Weekend Effect and the holiday effect are merely part of some more general **"closed-market effect."**

An index study by Ariel (1990) on the Dow Jones Industrial from 1963 to 1982 yielded the following results on the holiday effect:

- pre-holiday above average returns are **not** caused by outliers (i.e. one or two extreme observations in the data set, which would cause the results to be biased.)
- abnormal pre-holiday returns are **not** attributable to

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[7]For more information please refer to (Bradfield, 1990) page 8.

[8]This term is used by Lakonishok and Levi to describe the process whereby companies structure their balance sheets and income statements prior to the financial year end, so that the financial statements will display an orderly and profitable company.

[9]Another factor to consider is the phycological element. It could be that the buoyant and happy mood of the festive season carries over to the share market. However, such phycological elements are extremely difficult to analyze empirically, and will thus not be discussed any further.

increased risk[10]. In fact, the variance of pre-holiday returns was less than the variance of non-holiday returns. "Indeed, not only is the pre-holiday variance not greater than the variance for other days, the pre-holiday variance is actually lower than the variance of non-pre-holidays. This fact serves to emphasise that the high pre-holiday return is not a reward for bearing extra risk" (R. Ariel, 1990).
- Holidays **not** associated with market closings do **not** experience abnormal returns. This again lends support to the closed market hypothesis[11], since above average returns are a function of the market closing, and not a function of the holiday.
- Activity by specialists can be ruled out as a major causal factor for the high pre-holiday returns.

Bhana's study of the holiday effect on the JSE revealed the following:

(i) On average, the pre-holiday return[12] equals five times the return accruing on non-pre-holidays.

(ii) By sub-dividing the sixteen year sample period into two equal sub-sets, it was ascertained that the holiday effect has not varied substantially over time. (The results in the first period were similar to the results of the second time period.)

(iii) The high pre-holiday return is not a reward for bearing extra risk. In fact it was found that the pre-holiday variance was **less** than the variance on the other days of the week.

(iv) The pre-holiday strength[13] is only in evidence on the

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[10]It could be that the returns prior to a holiday are higher in order to compensate the investor for assuming a greater degree of risk. This was not found to be the cause of the abnormal pre-holiday returns.

[11]This hypothesis assumes that returns before and after a public holiday exhibit patterns similar to the Weekend Effect (Bhana, 1993).

[12]Pre-holiday return is measured in the same manner as returns for day of the week effects. Refer to equation {1} in Chapter Three.

[13]Pre-holiday strength relates to the disproportionate frequency of share price increases on trading days preceding holidays (Fields, 1934). The increase of the share price on a particular day is observed in the above average return on that day, since return is a comparison of the current price level (i.e. index level) to the previous day's price level (i.e. index level)

day immediately before the holiday. (ie Returns do not accrue on the days preceding the holiday. It is only the day immediately before the holiday that has abnormally large returns.)

(v) An investigation of the manner in which the closing price was determined, (bid or ask price) indicated that the bid-ask effect can be regarded as an important contributor to the high pre-holiday returns. (This is discussed further in this chapter[14].)

However, one possible weakness of the above study is the fact that over 33% of the pre-holiday days were Fridays. Consequently, the study may be documenting a holiday effect, whereas it is actually a Weekend Effect. In addition, nearly 20% of the holidays (Christmas and New Year) are in the December time period, and can be influenced by the December Effect documented by Bradfield and discussed above.

2.3 Intraweek Trading Patterns

One part of the study of seasonalities relates to intraweek trading patterns. These studies concentrate on the pattern of returns across the weekdays. The first paper dealing with the concept of intraweek trading patterns is that of Fields (1931). Fields conducted his study on the Dow Jones daily average of industrials over the period 1915 to 1930. At the time, there was the perception that share prices would generally decline on a Saturday (share markets used to be open on Saturdays in the U.S.) due to the unwillingness of security traders to carry their positions over until Monday, given the uncertainties over a weekend. However, this belief was found to have no foundation in fact. Contrary to popular opinion, Fields found that prices tended to rise prior to a holiday. He attributed this rise in prices to covering short sales prior to a holiday. He also expressed the guarded opinion that "commitments are covered more completely in anticipation of a holiday in a **declining market** than where the course of prices is upward." The explanation he gives is that those who invest on the upside are generally less experienced traders than those who undertake short sales.

In 1934, Fields carried out a formal test of the hypothesis he developed in 1931. He wished to test whether commitments are covered more completely in anticipation of an exchange holiday

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[14]The closing share price will be recorded as either the last trade price, bid price or ask price. The bid price is the price at which a broker is prepared to buy a share for a client and is usually lower than the ask price at which shares are to be sold for clients. Keim and Stambaugh (1984) hypothesized that market makers transacting at bid (ask) price with disproportionate frequency at market close on certain days might induce low (high) returns on these days. The high pre-holiday returns might likewise be caused by a disproportionate frequency of last transactions at the ask price.

in a declining market, than when the tendency of prices is upward. Should the evidence support this hypothesis, it would point clearly to the influence of short selling. The method used was to compare the index of the day immediately preceding every exchange holiday with the averages of the indexes of the two adjacent days. Thus, if the exchange was closed on Wednesday of any week, the index averages of Tuesday would be compared with the same measures on Monday and Thursday.

It is interesting to note from his empirical results that industrial indices average lower on Monday than on any other weekday. (This characteristic is common to almost all studies dealing with the Weekend Effect.) What is of particular interest is that negative Monday returns present in the bear markets of the early part of this century continue to exist in the bull markets of the 1980's. Fields took a close look at the 1929 - 1932 period and commented that "despite the severity of the decline during this period, the pre-holiday index displayed remarkable strength."

Consequently, Fields concluded that the rise in prices on the day prior to an exchange holiday, in a bear market, could be attributed to investors covering short commitments. One aspect of the data hampered his conclusion - the "tendency of stock quotations to strengthen on the pre-holiday is apparently not peculiar to years of declining prices [i.e. bear markets]". Field ended his paper by noting "it is submitted, however, that fertile seeds for a broader investigation of the whole problem are contained in this study." He could not have anticipated that these seeds would continue to grow 60 years later!

Fields therefore introduced the concept that share returns may not be the same on all days of the week. However, it was not until 1973 that the influence of weekends in particular was considered. Up to this point, researchers had not considered whether there was any dependence in successive daily share price changes[15]. Cross (1973) was the first to consider that dependence might occur on some days of the week, but not others. He investigated this hypothesis by considering the distribution of share price changes[16] on Fridays and Mondays, from 1953 to 1970. It was found that the Standard & Poors Composite Stock Index (hereinafter "S & P Composite") performed better on Fridays than on Mondays both in terms of mean percentage change and the

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[15]Fields had documented a rise in prices on the day before a holiday. However, he had not considered whether this had any relationship with price movements on other weekdays. Cross (1973) was the first to consider that a relationship might exist between the movement of the share price on Friday and Monday. Thus this was the first paper that considered the influence of the weekend on share price movements.

[16]The distribution of share price changes was investigated by studying the closing values of the Standard and Poor's Composite Stock Index.

percentage of times the index advanced in the eighteen years studied. In addition, it was found that should the index decline on a Friday, then the odds were three to one in favour of a decline on Monday. The converse did not hold true - there was an equal probability of the Monday index advancing or declining after an advance in the Friday index. These relationships were unique to Friday and Monday, and did not carry over to any other days of the week. Thus Cross documented "an example of non-random movements in stock prices." This non-random movement in share prices **appeared** to violate the efficient market hypothesis.

2.4 Calendar Time, Trading Time and Negative Monday Returns

French (1980) examined the process of share return generation. He performed tests to determine whether the distribution of daily returns on the S & P Composite supported the calendar time or trading time hypotheses.

2.4.1 Calendar Time Hypothesis

Fama (1965) was first to test the hypothesis that returns are generated in calendar time. He tested this hypothesis by comparing the variance of share returns on Monday with the variance on other days of the week. The calender time hypothesis assumes that asset returns are generated continuously during calendar time. Thus returns are generated irrespective of whether the market is open (trading) or closed (no trading). As a result, the distribution of returns for Monday should reflect the two day weekend interval where asset returns are generated, but the market is closed. Ignoring holidays, the returns reported for Monday represent a three-calendar-day investment, from the close of trading Friday to the close of trading Monday, while the returns for other days reflect a one-day investment (French, 1980). Consequently, Monday's mean return should be three times as large as the mean return for any other day of the week (Junkus, 1986). It should be noted that while Fama developed the calendar time hypothesis, he tested it by comparing the variance of returns across the weekdays; however, it was French (1980) who tested the theory by comparing returns across the days of the week. Once again the calendar time hypothesis assumes that returns are generated **randomly** over a period of time - irrespective of whether the market is open or closed. This would be a logical hypothesis, since the efficient market hypothesis posits that the share price reflects all available information. If it is assumed that information is generated continuously, then it should also be assumed that share returns are generated in continuous time. Thus, Monday's return should represent a three-calendar-day investment.

2.4.2 Trading Time Hypothesis

The trading time hypothesis assumes that returns are generated solely during trading hours. Consequently, the

distribution of asset returns for any particular day of the week is expected to be the same as any other day of the week, since the market is open for an equal number of hours on each weekday.(i.e. Monday's return is equal to Tuesday's return, which is equal to Wednesday's return etc.) No returns should be generated on non trading days, such as weekends and public holidays (Hess,1981;Junkus,1986). Clark (1973) was the first to develop a model in which returns are generated in trading time. However, Clark tested this model by simply comparing the variance of returns across weekdays, while French (1980) tested the model by comparing the returns[17] across the weekdays.

French tested the trading time and calendar time hypotheses[18] by comparing the returns on indices for different days of the week. The daily returns on the S & P Composite from 1953 to 1977 were used to examine whether returns are generated in calendar time or trading time. The results were surprising. The data was inconsistent with both models. Instead it was found that the mean returns for Monday were significantly **negative**, while the returns for the other four days of the week were positive (French,1980). This finding was not unique. Gibbons and Hess (1981) also found negative returns for Monday from 1962 to 1978 on the S & P 500, CRSP Value-Weighted and CRSP[19] Equal-Weighted portfolios. In addition, the negative Monday return is found by Cross (1973), but he fails to discuss these findings in his conclusion.

French goes on to examine whether the negative Monday return is unique to Monday, or whether it occurs on <u>any</u> day after the market is closed. He does this by comparing returns for days following holidays with 'non-holiday' returns. The results indicate that the "persistently negative returns for Monday are caused by some Weekend Effect, rather than by a general closed-market effect" (French,1980). It is unfortunate that French did not go on to examine Friday returns in more detail. It would have been useful to determine whether the Friday returns were abnormally positive, and if this were the case to determine whether this was a function of the market <u>closing</u> or a <u>Weekend Effect</u>. This relates back to Field's documentation of a rise in share prices on the day preceding a holiday due to covering short sales. This would indicate a closed market effect as opposed to

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[17]French's study of returns is important since it represented a new approach to testing the two hypotheses. In addition, his work is important in the context of this study, as this study tests whether returns on the Johannesburg Stock Exchange fit the calendar or trading time models.

[18]French tested these two hypotheses by means of regression analysis. The trading and calendar time regression equations are detailed and explained in equation {2} and equation {3} in Chapter Three. The three calendar day investment is adjusted for by dividing Monday's return by three.

[19]CRSP stands for Centre for Research in Security Prices.

a Weekend Effect. However, Board and Sutcliffe (1988) performed a similar study on the U.K. market and found no evidence to suggest that the negative Monday return was in fact a smaller part of some general closed market effect. Ariel (1990) researched share index returns on the trading day prior to holidays. He found that share index returns on these days were on average nine to fourteen times the mean returns for other days of the year. He also investigated[20] the possibility that this was not a simple manifestation of the Weekend Effect, and concluded that it was not. However, this conclusion is doubtful considering that 68 of the 160 pre-holidays fell on a Friday. It could be that the high pre-holiday return is part of the above average positive Friday return constituting part of the Weekend Effect.

French then considered the implications for market efficiency. He attributed the negative Monday return to the possibility that unfavourable information tended to be released over the weekend. However, he did not have any empirical evidence to support this hypothesis. He noted that these observations appeared to contradict the efficient market hypothesis. A negative return on a Monday should not have been in existence for such a long period of time. Investors would come to expect the release of unfavourable information on the weekends and would thus discount share prices appropriately throughout the week. "It is difficult to imagine any reasonable model of equilibrium consistent with both market efficiency and negative expected returns on a portfolio as large as the Standard and Poor's composite"[21] (French,1980).

Bhana (1985) tested the calendar and trading time hypotheses on the Johannesburg Stock Exchange (JSE). He used the same methodology as that employed by French. The data consisted of the daily closing value of the All Share Index during the period 1978 - 1983.

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[20]Ariel conducted this investigation by performing regression analysis. The daily share index returns were regressed against dummy variables for the days of the week plus an added pre-holiday dummy variable. The magnitude of the pre-holiday dummy represents the additional return earned on pre-holidays after adjusting for differing means across different days of the week. (Dummy variables are discussed in Chapter Three along with equation {2} and {3}.)

[21]French (1980) did not incorporate transaction and information costs into his statistical analysis. However, he concludes "the persistently negative returns for Monday appear to be evidence of market inefficiency. Although an active trading strategy based on the negative expected returns would not have been profitable because of transaction costs, investors could have increased their expected returns by altering the timing of trades that would have been made anyway". Despite the uneven pattern of returns across weekdays, no researchers have found a profitable trading rule, once transaction costs are accounted for, based on the day of the week anomaly (Harris, 1986).

The results were inconsistent with both the calendar and trading time hypotheses. The JSE, as with other international markets, exhibits a significantly negative Monday return while the average return for other days of the week is positive. However it was not Friday that exhibited the highest return, but rather Wednesday.

One of Bhana's recommendations is that follow-up studies should be undertaken as more information becomes available. This study proposes to do exactly that. The period studied by Bhana was short[22] in comparison to other international studies. Consequently, a study conducted on the JSE, with further data now available, serves to confirm or dispute Bhana's results. Should Bhana's results be confirmed by this study, it will provide clear evidence of the existence of a negative Monday effect on the JSE. However, should his results be disputed by the findings of this study, then it may call into question the existence of the Weekend Effect on the JSE.

Moreover, it may indicate that the Weekend Effect has disappeared or shifted over time. The study may find that the Weekend Effect has "shifted" to other days of the week. This might be explained by the behaviour of investors, who (through publications) have become aware of the Weekend Effect. Consequently, investors may sell shares on a Wednesday and buy on a Monday. These very acts would serve to nullify a high Wednesday and low Monday. Consequently the study may find a high Monday and low Wednesday due to an over reaction of investors!

In addition, this investigation extends Bhana's analysis in several new and important ways:

(i) The literature review did not discover any study that has investigated the different components of the JSE All Share Index. Bradfield (1990) pointed out that the JSE is unique in comparison to international markets. This is due to the influence of gold shares on the All Share Index. In addition, several of the international studies were performed on their industrial indices. Consequently, it is vital to split any study of the All Share Index up into both the Industrial and the Gold Indices. This will improve the comparison of this study's results to earlier findings. It may be that the Gold Index has a unique day of the week effect that influences the behaviour of the All Share Index. Thus the Industrial Index (which is arguably more closely aligned to international share indices) may demonstrate a similar negative Monday and high Friday return, but due to the unique influence of the Gold Index a situation exists where Wednesday has the highest return.

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[22]Bhana's empirical study was based on only five years of data, whereas other international studies are typically based on at least twelve years of data. This study is based on seven and a half years of data on the All Share, Industrial and Gold Indices. If Bhana's study period is combined with this thesis' study period, then twelve and a half years of data are available.

(ii) The study investigates what influence (if any) the introduction of the futures market has had on the equities market - in particular the effect it has had on the three indices (ALSI, INDI, GLDI) on which there are futures contracts. An additional financial instrument that may have had an impact on the behaviour of the All Share Index is the Equity Linked Fixed Interest (ELFI) security issued by Transnet. Returns behaviour of this particular instrument is similar to that of a futures contract, since it's trading value and redemption value are also linked to the level of the All Share Index. Finally, options may also have an influence on the level of the indices, but the extent of such impact has probably been limited due to the negligible trade in equity options.

(iii) This study investigates possible explanations for the existence of the Weekend Effect on the JSE. The study looks at the influence of settlement delays by considering the impact of interest effects. This is made all the more interesting by the fact that the settlement period changed from fourteen business days to seven business days during the period of study (26 February 1986 to 3 March 1993). In addition this study considers what effect, if any, dividends have on the closing level of the share indices, and consequently on the returns on these indices.

2.5 Possible Explanations of the Weekend Effect

Many researchers have documented an empirical anomaly which appears to contradict the efficient market hypothesis, trading time hypothesis and calendar time hypothesis. Recently the focus of research has shifted, attempting to discover a reasonable explanation for the negative Monday return. Many possibilities have been considered, and are discussed below:

2.5.1. Infrequently Traded Small Issues

Gibbons & Hess (1981) confirmed previous findings of the negative mean Monday return. They found that from 1962 to 1978 the average annual return on Monday ranged from -33.5% for the S&P 500 to -26.8% for the equal-weighted index. Since they were unaware of any theory that would predict negative Monday returns, they considered whether the results could be explained by inappropriate statistical assumptions. **Small issues** tend to trade infrequently. Gibbons & Hess state that "if small issues tend to trade more frequently on Friday than other days of the week, the mean of the observed returns of an index would be high on Friday and low on Monday." However, this would still not explain the **negative** Monday return. In addition, the theory assumes that when shares are traded frequently, their prices increase. This is not a valid assumption, since shares may trade frequently in a declining (bear) market as well as in a rising market. To overcome the nontrading problem Gibbons & Hess reperformed the

tests using only actively traded shares[23]. Results indicated that the negative Monday return was common to both frequently and infrequently traded shares. At the same time it was discovered that sample variances did not show a strong Monday effect.

Bradfield (1990) conducted a study on the estimation problems caused by thin trading on the JSE for the period January 1978 to August 1987. The study revealed "that the extent of thin trading on the JSE is indeed significant. ....Consequently, the estimation procedures using recorded security prices are likely to be significantly affected by the thin trading phenomenon on the JSE." The main cause of the problems associated with thin trading is the fact that *recorded* prices are used to represent true *underlying* prices. This may not be the case, since the recorded price represents the last price at which a trade takes place. On a thinly traded market, such as the JSE, the recorded price may be several weeks old. Thus the last recorded price may not represent the current underlying price. This would cause problems for any empirical study, since any "statistical inferences made on this basis would be distorted."

This study needs to consider the impact, if any, caused by thin trading. Bradfield suggests that where the proposed beta estimator is needed, a statistical manipulation of the data should occur[24]. In this study the beta estimator is not required, and thus it is not necessary to perform this statistical manipulation. More importantly, one of the requirements for the inclusion of a share in an index[25], is that it must be frequently traded. By definition, all shares forming the indices are frequently traded and thus the recorded prices closely represent the underlying prices. Consequently, it is considered that the components of the indices do not suffer from a lack of trade, and thus the indices themselves do not suffer from the problems associated with thin trading.

2.5.2.) Heteroscedasticity

Gibbons & Hess (1981) considered the problem of **heteroscedasticity.** (It is assumed that the covariance matrix is the same for all days of the week. This assumption may not be valid. To avoid heteroscedasticity the regression equation is standardized by the estimated standard deviations for each day of the week. The statistical concepts are explained in more

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[23]To overcome the nontrading problem, as well as to determine the extent of the Monday phenomenon across shares, Gibbons and Hess performed the tests on firms included in the Dow Jones 30. All of these shares are actively traded.

[24]The exact manipulation is not documented in this paper, but can be found in - Cohen et al. (1983) Journal of Financial Economics, 12, pgs 263 - 278.

[25]Source - 1993 Actuaries Index booklet.

detail at a later stage.) "The heteroscedasticity adjustment had no important impact on the conclusions" (Gibbons & Hess,1981).

Since Gibbons and Hess found that the heteroscedasticity adjustment had no major influence on the results of their study, it is not considered necessary to make any adjustments to the data in this study.

2.5.3.) Institutional Features

Researchers have also considered the impact of **institutional features**[26]. The share market exhibits a strong negative Monday return, but is this unique to the share market i.e. are day of the week effects caused by institutional features unique to share markets? The hypothesis was tested by considering whether the same results were found in the U.S. Treasury Bills market. Results[27] indicated that treasury bills exhibit strong day of the week effects, which are qualitatively the same as the share market. Yadev and Pope (1991) also found intraweek and intraday trading patterns on the London International Futures Exchange (LIFFE). The futures contracts used in their study were based on the FTSE100 index for the period April 28, 1986 to March 23, 1990.

Studies on the South African Post Office Bonds, Eskom 168 and RSA bonds by Hattingh & Smit (1992) indicate that the seasonal pattern in daily price movements is not restricted to the JSE. Six types of seasonal patterns are observed: day-of-the-week effect, week-of-the-month effect, turn-of-the-month effect, January effect, January vs other non-turn-of-the-month effects and turn-of-the-year vs turn-of-the-month effects. Bhana (1985) extended his study of the indices to the Treasury Bills Market to determine whether the Weekend Effect is unique to the equities market. His results indicate that there is a similar pattern for the returns of Treasury Bills, and thus "it would seem that the weekend phenomenon is widespread across other types of financial assets."

It appears as if the day of the week effect in South Africa is not unique to the share market. This observation corresponds with international findings. It will be interesting to perform studies on futures prices and option prices to determine if they also

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[26]These institutional features include, for example, the manner in which trade occurs (screen traded or open outcry), transaction costs, liquidity levels, etc.

[27]Gibbons & Hess (1981) find a negative Monday return for USA treasury bills. Flannery and Protopapadakis (1988) document from 1977 to 1984, a negative Monday seasonal in a variety of U.S. Treasury bills. Significant day of the week effects are also documented in the federal funds market by Cornell (1983) and Eisemann and Timme (1984) and in markets for foreign exchange by McFarlane, Pettit, and Sung (1982).

exhibit day of the week effects. These topics could form the basis for future research.

2.5.4.) Measurement Error

Gibbons & Hess (1981) also considered the possibility of **measurement error**[28]. All empirical research assumes that security prices are observed without measurement error, although this may not be true in practice. One possible error that can arise with infrequently traded shares, is that the share price is out of date. Friday's return had shown a tendency for above-normal returns. Consequently, they investigated the possibility that Monday's negative returns are explained by Friday's above-normal return. This is because Monday's return is calculated by dividing the difference between Monday's closing index value and Friday's closing index value, by Friday's closing index value[29]. Should Friday's closing index value be abnormally large, then it would cause Monday to have a negative return. One would expect the average combined return for Friday and Monday to not be significantly different from the average return for other days of the week. Gibbons and Hess therefore tested whether there was a measurement error by adjusting Friday and Monday's return with Wednesday's mean return. The results indicate that measurement errors do not provide an adequate explanation of the Monday phenomenon. However, this test assumes that Wednesday's mean return is not significantly different from other day's means. This statistical assumption was re-addressed by Keim and Stambaugh (1984) whose findings are discussed below. Consequently, tests based on offsetting Friday and Monday mean returns fail to support the hypothesis of measurement error.

Keim and Stambaugh considered an alternative test for the presence of measurement error. They looked at the possibility that Friday's return is subject to 'random errors' that are, on average, positive, while Monday's return is subject to random errors that are, on average, negative. This implies that "if measurement error plays an important role around the weekend, then the correlation between Friday's return and Monday's return will tend to be lower (perhaps negative) than between other successive days." The results showed that the average correlation between Friday's return and Monday's return is the highest of all the days. This is opposite to what a measurement error

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[28]Measurement error is based on the assumption that there may be systematic errors in the data across weekdays. Gibbons and Hess (1981) do not try to give an explanation for the systematic errors, but are content to test the hypothesis that the negative Monday return is the result of an above average Friday return.

[29]For the formulae, refer to equation {1} in Chapter Three. However, if Friday's closing index value is always above average, then Monday's closing index value would on average be lower than Friday's closing index value. This would cause Monday's return to be negative, since the numerator in the equation is Monday's closing index value minus Friday's closing index value.

explanation would predict. These findings were consistent with Cross' evidence which suggested that correlations between Friday and Monday returns are the highest of any pair of successive days. In addition, Jaffe and Westerfield (1985) provided international evidence that measurement errors do not explain the Weekend Effect by studying daily share index returns on the U.S., U.K., Canadian, Japanese, and Australian[30] share markets. Harris (1986) considered three new tests of the high Friday closing price, and came to the conclusion that "It is unlikely that the Weekend Effect .....is the result of manipulated Friday closing prices."

Board and Sutcliffe (1988) considered the measurement error hypothesis for the U.K. share market, by using daily closing values of the Financial Times All Share Index from 1962 to 1986. They investigate the possibility that negative returns on Monday are caused by an upward bias in Friday's closing price or a downward bias in Monday's closing price. This would lead to a high Friday return and a low Monday return, i.e. the Weekend Effect. However, the overall return from Thursday close to Monday close would be unaffected. After testing this proposal, they confirm that systematic measurement errors are not the cause of the Weekend Effect.

The numerous studies involving measurement error conducted on almost all the international markets have failed to produce any significant explanation of the Weekend Effect. For this reason it is considered appropriate to ignore the possible effects of measurement error in this study.

2.5.5.) Interest Effects of Settlement Delays

Up to this point the settlement delays in transactions have not been considered. The research has assumed that share purchases/sales result in instantaneous payment. Clearly this is not the case, as payment normally occurs several business days after the actual transaction date. The **interest effects of settlement delays** need to be considered. This means that the spot price is really a forward price - spot price grossed up by the riskless rate of interest for the period of the settlement delay[31]. In the U.S. share markets prior to February 10, 1968,

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[30]Indices used were: Japan - Nikkei Dow from 1970 to 1983, Canada - Toronto Stock Exchange Index from 1976 to 1983, Australia - Statex Actuaries Index from 1973 to 1982, U.K. - Financial Times Ordinary Share Index from 1950 to 1983, U.S. - S & P Composite from 1962 to 1983.

[31]The interest effects of settlement delays are factored into the price that is quoted, as payment does not occur instantaneously. Thus, the spot price is really a forward price which is equal to the equivalent of an instantaneous cash settlement amount plus an interest amount. The interest amount increases as the time between deal date and settlement date

the settlement period was four business days. Subsequently it changed to five business days. Any settlement period that is not a simple multiple of five business days creates a possible day of the week effect. With a four business day settlement period, Monday's spot price should be grossed up by four days of interest, whereas Tuesday's through Friday's spot price should be grossed up by six days - four business days and two weekend days. This asymmetry in settlement periods could cause Monday's return to be lower than the rest of the week. After February 10, 1968, no day of the week effect should be observed, since the settlement period was just five business days.

Since daily interest data is not easily available, Gibbons & Hess (1981) used an alternative technique. "If the negative effect on Monday is due to settlement periods, stock returns should be high enough on Tuesday to compensate for Monday's falloff. By testing for this effect, the linkage between the day of the week anomaly and settlement procedures can be examined." The results indicate that settlement procedures do not explain day of the week effects. This result should have been expected since the negative Monday return was still in existence after February 10, 1968, when the settlement period was 5 business days. Gibbons & Hess then make an interesting comment. Instead of concluding that weekly seasonalities contradict the efficient market hypothesis, they conclude that equal expected returns for all weekdays is merely a convenient statistical assumption. "From a scientific point of view, it is more useful to conclude that the results are strong evidence that equilibrium returns vary across days of the week." Consequently any other studies trying to evaluate market efficiency must take day of the week effects into account. Lakonishok and Levi (1982) confirm that day of the week effects do not contradict the efficient market hypothesis but that they "could potentially influence conclusions about, for example, market efficiency." It should be noted that only if one could consistently earn excess returns by forming a trading rule based on day of the week effects, would such a trading rule contradict the efficient market hypothesis. One such trading rule would be to purchase the index on Monday, and sell on Friday. However, even if day of the week effects do not contradict the efficient market hypothesis, they still represent an interesting anomaly that has yet to be fully explained. In addition, researchers often make the plausible assumption that returns are even across all weekdays. As has been documented, this assumption is at odds with economic reality.

Lakonishok and Levi (hereafter L & L,1982) modified Gibbons and Hess' study relating to settlement effects using the closing value of the CRSP equal- and value-weighted indices between July 1962 and December 1979. L & L's argument was based on the delay between trading and settlement in shares **and** in clearing cheques. After February 10, 1968, the clearing delay means that in weeks without a holiday, shares purchased on business days other than Friday give the buyer **eight** calender days before losing funds for

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increases (i.e. the settlement period increases.)

share purchases. These eight days are the five business days for settlement, the two weekend days, and the cheque clearing day. Shares purchased on a Friday result in payment occurring **ten** calender days later. These ten days are made up of five business settlement days, four weekend days and one day for cheque clearing. Buyers should therefore be prepared to pay more for shares purchased on a Friday by the amount of two days of interest. This means that equilibrium expected returns on Friday will be higher than any other day of the week by an amount of two days of interest.

Prior to February 10, 1968, the settlement period was four business days, and one day for cheque clearing. L & L did not therefore expect a day of the week effect to be present prior to 1968. Without carrying the study any further, they should have realised that the hypothesis could not have worked, since all previous studies had documented a negative Monday return before to 1968. Dyl & Martin, 1985, criticise this very point. L & L (1985) reply that the settlement period prior to 1968 was , in practice, longer than the four day official settlement period. It was due to the inability of investors to settle transactions in four business days that lead to the introduction of the five day settlement period. L & L then considered the impact that holidays have on these settlement periods. It is sufficient to note that, due to interest rate effects, holidays affect equilibrium expected returns in a complex fashion.

Consequently, L & L considered unadjusted returns from 1962 to 1967 and returns adjusted for interest effects from 1968 to 1974. The results indicated that the extra return on Fridays, after the adjustment, was extremely small. However, the adjusted returns still did not fully eliminate the excess Friday return or the negative Monday return. L & L concluded that settlement procedures and cheque clearing delays provide only a <u>partial</u> explanation of the Weekend Effect. Their results showed that the settlement effect accounts for only 20% of the Weekend Effect. They also noted that it appeared as if the negative Monday effect had disappeared during the period 1974 to 1979. However, Dyl and Martin (1985) note that the negative Monday return re-appears in 1980 to 1981 and that "perhaps L & L have overstated the case for the demise of the Weekend Effect." Theobald and Price (1984) conduct a similar study on the U.K. equities market, which is discussed below.

Jaffe and Westerfield (1985) conducted a study of settlement procedures on equity markets in Canada, U.K., Japan, and Australia. They concluded that settlement procedures in the U.K., Japan, and Canada do not explain the weekly seasonal at all. In fact, their results show that seasonal patterns increase after an adjustment for settlement costs in each country. In Australia, settlement procedures may account for part of the high returns on Thursday and Friday, although probably not for the low returns on Monday and Tuesday. This conclusion seems harsh, particularly in light of L & L's study regarding the U.S. market. There is little doubt that, in theory, adjustments should be made for interest costs. Whether this actually occurs in practice is the

open to debate. It seems extremely unlikely that investors attach no time value to money, or that the adjustment is trivial in comparison to normal daily returns. It would seem that an adjustment for settlement is necessary in any empirical study. Although the adjustment is not sufficient to fully explain the magnitude of the Weekend Effect, the required interest adjustment has a magnitude of some relevance.

Solnik and Bousquet (1990) considered the impact of settlement effects on the Paris Bourse[32]. In France, the settlement of all transactions takes place once a month on a fixed date. This settlement procedure is likely to affect the distribution of daily share returns. The magnitude of the effect ought to be up to one month of interest. Thus the French market provides a good opportunity to test the importance of settlement procedures, since the interest effect should be large in comparison to the other markets that had been tested. It was found that the mean return on the first day of a new 'account' was more than ten times the mean return for other days of the week. This extra return converted into approximately one month of financing cost, at the short term interest rate. Consequently, the theoretical prediction, in regard to settlement effects, appeared to be correct. However, it was found that all days of the week displayed a positive return, except Tuesday. This was not totally unique, since a negative Tuesday return had also been documented in Australia, Japan and Singapore. However, it was the first time that a negative Tuesday return had been documented in Europe. Later, Solnik (1990) updated the study of the Paris Bourse to take account of more recent data and to adjust for dividends. The conclusion did not change, as the monthly settlement period still did not explain the day of the week effect observed on the Paris Bourse.

Yadev and Pope (1991) studied the U.K. equity market[33] and found that prices rose between 3p.m. and 5p.m. on Friday afternoons. This was due to interest effects - the end of an account is actually at 3.30p.m. on the last Friday of an account. However, the magnitude of the average price change was found to be much smaller than the average value of the interest that should have been reflected in cash prices. Hence, consistent with the results of Solnik (1990) and Solnik and Bosquet (1990) for the Paris Bourse, the market does not appear to efficiently incorporate into prices the entire effect of interest costs inherent in its settlement procedures.

It is clear that the interest effect on settlement delays is an

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[32]Solnik and Bousquet conducted their tests on the CAC index from 1978 to 1987. The index is a market-capitalisation-weighted index of all the major listed French companies.

[33]The research was based on the Financial Times Index for the period 28/4/1986 to 23/3/1990. The Financial Times Index is an arithmetic average, market value weighted index of the one hundred (highest capitalisation) shares.

important contributor to any seasonality study. For this reason, the settlement delays associated with trades on the JSE must be taken into account. The settlement period on the JSE was fourteen business days prior to 30 May 1991, but was changed to seven business days. When the settlement period was fourteen days, it would have resulted in any Wednesday, Thursday or Friday purchases having two extra days in which to pay. Thus the index levels for these three days should be adjusted downwards by the equivalent of two days of interest. When the settlement period was changed to seven business days, it caused only a Friday purchase to result in an extra two days in which to pay. Thus after 30 May 1991, only the Friday index level should be adjusted downwards by two days of interest. Clearly public holidays have a complex effect on the settlement delays, and need to be taken into account. The settlement delays unique to the JSE are discussed in more depth in Chapters Three and Four.

2.5.6.) Timing of Corporate Earnings and Dividend Announcements

Wolfson and Patell (1982) considered the impact of the **timing of corporate** earnings and dividend announcements. More specifically, they investigated the possibility that good news is consistently released during trading hours while bad news is delayed until the market is closed. The classification of good and bad news is clearly a relative concept - that is relative to market expectations. The exact classification of good and bad news is an extremely difficult task. Wolfson and Patell classified earnings and dividend announcements as good or bad based on two criteria:

(i) Using an expectation model (based on the preceding years data) the announcement is classified as good or bad.

(ii) An endogenous model where share price movements following the announcement provide an indication of whether the news was good or bad.(Price increases signalling good news and price declines indicating bad news.) A weakness of this model is that it assumes the observed price change is due solely to the dividend or earnings announcement.

The results indicate that price changes are more likely to be positive for announcements made during trading time. There is a marked shift toward negative price changes for after-trading announcements. This indicates that bad news tends to be delayed until the market is closed. Abelson attributes the delay "to an old corporate trick: when the news is bad put it out on Friday night - and hope it gets lost by Monday morning." It appears that Abelson ignores the efficient market hypothesis. Under the efficient market hypothesis it is not possible to fool the market by simply hoping that the news will get "lost". Other possible reasons for bad news to be delayed until the market is closed must be considered. One plausible explanation is that firms want bad news to be properly digested before investors react to such new information. Directors may fear that if such bad news is not properly evaluated, then it may lead to panic selling, which

harms the firm's reputation. In any event such an hypothesis does not go a long way to explaining the Weekend Effect. In an efficient market investors come to expect the release of unfavourable news on the weekend, and share prices are discounted through the rest of the week.

The impact of the timing of company announcements is difficult to quantify and classify. Since this possible explanation is relatively subjective, and the fact that rational investors would discount the possibility of "after-hours bad news", it is not dealt with in this study of the JSE.

2.5.7.) Thin Trading and Price adjustment Delays

Theobald and Price (1984) formally analyse the impact of **nontrading/ thin trading and price-adjustment delays** using U.K. share index data from 1975 to 1981. Thin trading and price-adjustment delays cause the "observed" price to differ from the "true" price and thus the "observed" return distribution to differ from the "true" return distribution. This causes a number of statistical problems - nontrading impacts upon the measured means, variances and autocovariances of the return distributions. Clearly these factors influence any intraweek seasonality study[34].

Theobald and Price illustrated the impact of thin trading by using two U.K. indexes - the Financial Times Ordinary (FTO) and the Financial Times All Share (FTAS) Indexes. The FTO consists of the leading thirty U.K. equity shares, while the FTAS is made up of about seven hundred and fifty shares. Since the FTAS is a broader-based index, it contains less frequently traded shares and is thus more affected by nontrading due to its broader composition. An analysis of the two indices provides considerable evidence of non-normality in the underlying returns as well as a negative Monday return. In addition "the measured seasonality in the mean was generally stronger in the case of FTO which is consistent with the impact of nontrading." (Theobald and Price, 1984)

The lack of tradeability on the JSE has already been discussed. In theory one might construct an index of the leading thirty JSE shares, and compare the results to those obtained for the All Share, Industrial and Gold Index. However, this is extremely difficult to do, as no such index currently exists. This exercise cannot be performed due to practical constraints. However, the index constituents have to meet various criteria set by the JSE Actuaries Department. One of these criteria is tradeability. For the purposes of this study it is sufficient to document the problems caused by the lack of tradeability, but to note that these problems are mitigated by the selection procedures for the index constituents.

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[34]For a more complete discussion refer to Theobald and Price, 1984, pg 378.

2.5.8.) Dividend Effects

Theobald and Price also investigate the impact of **dividends** on the Weekend Effect. Should shares typically go ex-dividend on Mondays, then one would expect the share price to drop by the present value of their dividends on that Monday. This is because the dividend is factored into share price, and thus when the share trades ex-dividend the share price drops by the amount of the dividend. They investigate this possibility by partitioning Mondays into ex-dividend days and non-ex-dividend days. The results were a surprise. The non-ex-dividend Mondays showed a more strongly negative return than the ex-dividend Mondays. This was totally inconsistent with the researchers' expectations.

However, the answer is found in the unique settlement procedures of the U.K. market. Once one takes interest rate effects into account, the anomaly is explained. The U.K. stock exchange has accounts which usually open on a Monday and are two (sometimes three) weeks long. Payment for shares bought is due on the second Monday after the end of an account. Shares bought on the first Monday of an account will only be settled three weeks (twenty one days) after transaction date. These three weeks are made up of the two weeks of the account period, and the one week to the second Monday after the end of the account period. Thus, the first Monday of an account incorporates a twenty one day interest gross-up adjustment. One would expect the first Monday of an account to exhibit an above average return, due to the interest effect. The positive effect is tempered by the fact that the first Monday is generally the ex-dividend date. Thus the apparent anomaly of positive share returns on ex-dividend Mondays is explained by taking interest rate effects into account. In this manner, Theobald and Price, confirm the results of Gibbons and Hess (1981) and L & L (1982). In so doing, they provide a plausible reason for differing Monday effects between the U.K. market and the U.S. market. They also highlight that the Weekend Effect is of a somewhat more complex nature than that in the U.S[35]. This is almost certainly due to the more complex settlement procedures employed in the U.K.

Board and Sutcliffe (1988) also considered settlement and dividend effects in the UK market by studying the closing values of the FTAS Index between 1962 and 1986. They highlight that shares go ex-dividend on the first Monday of an account. However, they sub-divide Mondays into "First Mondays" of an account, and "Other Mondays". The results are enlightening. "First Mondays" have a positive return and "Other Mondays" have a negative return. The "First Monday" positive return is due to the positive settlement effect outweighing the negative ex-dividend effect. Consequently, the negative Monday anomaly is still present, but in a somewhat more complex manner. Board and Sutcliffe suggested that previous studies indicating the demise of the negative Monday effect were incorrect. In reality the positive "First Mondays" were now outweighing the negative "Other Mondays",

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[35]See Board & Sutcliffe,1988.

creating the impression that the negative Monday effect had died out. These U.K. results were confirmed by Yadev and Pope (1991).

Phillips-Patrick and Schneeweis (1988) investigate the impact of dividends on U.S. shares, by comparing the daily return on the CRSP index which includes dividends and the daily return on the CRSP index which excludes dividends. They find that the mean dividend yield on Monday is statistically different from each of the other four days of the week. Tests prove that the divided yield accounts for a portion of the Weekend Effect, but does not provide the full explanation. Solnik (1990) studies the impact of dividends on the Paris Bourse, and concludes that dividends do influence the Weekend Effect, but not enough to fully explain the intraweek trading anomaly.

Lampbrechts (1988) recognises the seasonality of dividends on the JSE. He notes that 96% of companies have their year-end in either December, February, March, June or September. He comments that "a fluctuating dividend payout pattern may therefore significantly impact on theoretical prices." For the purposes of this study it is important to distinguish if dividends are paid on any particular **day** of the week. What is important is the last day to register (LDR), since it is only shareholders who are registered on this day that receive the dividend. Thus if a particular day of the week has a disproportionately high number of LDR's, then the following day would see the shares go ex-dividend. This would cause a drop in the share price. If it is found that shares typically have their LDR falling on a Friday, it would serve to explain the negative Monday share returns. This paper is unaware of any local study that has evaluated the LDR on a daily basis. Previous studies have only evaluated the LDR on a weekly basis. Unfortunately these studies are of no use in this research. This study needs to determine if the LDR tends to fall disproportionately on a particular weekday. If it does, then modification of the daily returns is needed so as to adjust for any impact of the LDR. It is interesting to note Levett's (1991) study of share index futures which observes that "nearly all company's LDR dates fall on a Friday." This study needs to adopt a sounder statistical approach. This may involve ascertaining when the top ten or twenty companies of a particular index regularly have their LDR. In this manner we will be able to conclude that at least X% of the index have their LDR on a particular day.

2.5.9.) Specialist-Related Biases

Keim and Stambaugh (1984) confirmed the existence of a Weekend Effect in their study which used a fifty five year period. The study was performed on the S & P Composite from 1928 to 1982. It is interesting to note that the returns for 'one-day' weekends are consistently negative and not statistically different from the 'two-day' weekend returns. (A 'one-day' weekend existed when the exchange was open on a Saturday from 10.00a.m. and 12a.m.) Jaffe and Westerfield (1985) documented similar findings in the Japanese market, which is open on Saturdays. These results suggest a tendency for higher returns on the last trading day of

the week, whether that day is a Friday or Saturday. The researchers also considered whether the Weekend Effect is found for firms of different sizes (i.e. market capitalisations). The results indicate that day of the week effects are evident for both large and small firms, but the smaller the firm, the greater the tendency for average returns to be high on Friday.

Keim and Stambaugh then posited a new explanation for the Weekend Effect arising from **specialist-related biases.** Returns on the share market are computed from closing prices, where the closing price is the price at which the last transaction occurs. On stock exchanges, this transaction often involves the specialist, and thus the closing price is essentially a bid or ask price, as opposed to the true[36] market price. Should there be differences in the frequency of bid and ask prices, or should bid/ask prices prevail on a particular weekday, it could lead to a weekly seasonal in share returns[37]. "In order to investigate the above conjecture, we examine returns computed with bid and ask quotations of shares quoted over the counter (OTC market). The use of bid-to-bid (or ask-to-ask) returns allows a direct test of whether day of the week effects are due to the bid-ask bias" (Keim & Stambaugh, 1984). Their evidence indicates that the day of the week effect is not due to systematic differences between true prices and closing prices recorded on the exchanges. It is, therefore, unlikely that the presence of the specialist accounts for day of the week effects. Jaffe and Westerfield (1985) repeated Keim and Stambaugh's tests on share market index returns for U.K., Japan, Canada, and Australia. Their results were consistent with Keim and Stambaugh, as they found no support for the specialist-related bias.

Bhana (1993) conducted a "rough" test on the JSE, to determine the extent of the bid-ask bias. He collected the bid, ask and closing prices for thirty randomly selected shares on twenty seven different days. Bhana's results contradicted Keim and Stambaugh's results. Bhana concluded that "the bid-ask effect can be regarded as an important contributor to the high pre-holiday returns." It should be noted that the effects of the bid-ask bias may not be significant in the case of index constituents, since they are defined to be highly tradeable shares, and thus the bid-ask spread is likely to be insignificant for shares making up the indices[38]. None the less, the impact of the bid-ask bias is

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[36]Theobald and Price (1984) define the "true" market price as being those prices that would arise in the absence of frictions in the trading process.

[37]Given the nature of the results, the high Friday returns would indicate a greater proportion of ask prices, while the negative Monday return would indicate a greater proportion of bid prices.

[38]Bhana randomly selected thirty shares for his test to determine the extent of the bid-ask bias. The shares selected in his sample are not detailed in his paper. However, if the

investigated in this study. The method in which it will be evaluated is discussed in Chapter Three.

2.6 Returns - Trading Time or Non Trading Time?

Rogalski (1984) extended day of the week studies further by distinguishing between trading and non-trading day returns. Most previous research had defined returns as being a comparison of the closing level of the previous day's index to the close of the current day's index. Over a weekend this would imply that the return is the closing level of the index on Monday divided by the closing level of the index on Friday. Such a technique fails to distinguish when the returns actually accrue - over the non-trading weekend or during trade on Monday? Rogalski investigated whether returns accrue during trading time or non trading time by considering closing **and** opening prices. In this manner he could ascertain when the negative Monday returns arise. His results indicated that all of the negative average return for the S&P 500 occurred during the non-trading period from the Friday close to the Monday open. "Thus, the Monday effect discovered by French.....may actually be a **Weekend Effect.**"(Rogalski,1984) Rogalski then re-considered the trading time hypothesis - this time defining returns as being the open to closing level of the index on any one day. This is a more correct test of the trading time model, since it only looks at returns that are generated during actual trading hours. The results were consistent with the predictions of the trading time model. Each day of the week had equal trading time returns. " French may have incorrectly rejected the trading time model because he used close to close returns instead of close to previous open returns to represent trading day returns."(Rogalski,1984) Rogalski reperformed the analysis using close to close returns and also ended up rejecting the trading time model. It would appear that any test of the trading time hypothesis should be based strictly on trading time returns.

Harris (1986) replicated Rogalski's tests using the share prices of all shares listed on the New York Stock Exchange(NYSE) from 1981 to 1983. The results were somewhat different. Only half of the negative Monday close-to-close return accrued between Friday close and Monday open. The rest of the negative Monday effect accrued during the Monday trading period. The contradictory results were due to the differing composition of the indices. Harris discovered that for large firms, negative Monday close-to-close returns accrue before the market opens, (ie during the non-trading weekend period) while for smaller firms most of the negative Monday return accrues during trade on Monday. The S &

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selected shares did not form part of the indices, then his results are of little relevance to this study, because this study is concerned with index constituents only. Shares making up the index have to meet the criteria of being highly tradeable, and thus the bid-ask bias is likely to be insignificant.

P 500 is mostly made up of large[39] shares, while the NYSE index is composed of large and small shares. This would go to explain why Rogalski documented the negative Monday return accruing over the non-trading period, while Harris noticed that it accrued partly over the weekend and partly over the Monday trading period for the NYSE index.

Yadev and Pope (1991) considered when returns accrued on the London Stock Exchange. They found that the returns accrued during the trading period on Monday. However, in contrast to Harris, there was no systematic negative price change over the weekend. In fact, a significant proportion of the Friday close to Monday open price changes were actually positive. This would indicate no Weekend Effect, but rather a Monday trading period effect.

Clearly it is of interest to determine exactly when the returns on the markets arise. This study has never been performed on the JSE. Unfortunately such an analysis is not be possible, since only the closing value of the index is available. Consequently one cannot distinguish as to when the returns arise, and thus one cannot conclude whether it is a "Weekend" or "Negative Monday" phenomenon, if indeed such a phenomenon exists on the JSE.

2.7 Is it an International Anomaly?

Jaffe and Westerfield (J & W,1985) realised that most of the research regarding the Weekend Effect had been done using U.S. and U.K. share returns which documented similar results. J & W decided to investigate the possibility that the Weekend Effect is in fact some sort of **international anomaly**. Thus, they examined share returns in the U.K., Japan, Canada, and Australia. When these markets are combined with the U.S. market, they make up 87% of the world's market value of exchange-listed securities. All these markets are open from Monday to Friday except Japan, which is also open on Saturdays. The results indicate that the Weekend Effect is in fact an international anomaly. In each case the last trading day of the week showed the highest mean return, i.e. Saturday for Japan and Friday for all other countries. This evidence is consistent with that of Keim and Stambaugh, who found positive share returns, in the U.S. on Saturdays prior to 1968. In all countries, a negative Monday return was documented - but in the case of Japan and Australia the lowest mean return occurred on Tuesday. This phenomenon is confusing since it was not found in past studies regarding the U.S. and U.K., and was not found in Canada.

One possible explanation is the **time zone differences** between these markets. The Tokyo Exchange is fourteen hours ahead of the New York Exchange and the Sydney Exchange is fifteen hours ahead. London is only five hours ahead of New York while Canada is only one hour behind. This means that the U.S. trading is never concurrent with the Australian and Japanese markets. Because of these differences, the daily trading patterns in Australia and

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[39]Large in terms of market capitalisation.

Japan could be identical to, but one day ahead of, the trading patterns in the U.S. This hypothesis seems quite plausible when you consider that Australia and Japan have the most negative return on Tuesday, and not on Monday as documented for the other countries. However J & W "conclude that foreign investors confront a week end effect in their respective share markets independent of the week end effect in the U.S." (J & W,1985) Thus the negative 'Tuesday' return in Australia and Japan seems to complicate the weekend anomaly even further. However, J & W added to existing knowledge by proving that the Weekend Effect is not unique to the American and European share markets.

J & W then considered whether the seasonal pattern in **foreign exchange** rates offsets the Weekend Effect in shares for Americans investing overseas. McFarland,Pettit and Sung (1982) found that returns on foreign currencies to a U.S. investor are generally high on Mondays and Wednesdays and low on Thursdays and Fridays. It would seem that the high returns on the foreign currency market tend to offset the low domestic returns on the international share markets, and vice versa. Thus an integration of foreign currency markets with U.S. share markets may help explain the day of the week effects. It would not, however, prove which was the cause of day of the week effects. Unfortunately, the tests[40] conducted by J & W caused them to conclude that the seasonals found in foreign exchange markets do not offset the seasonal in foreign share markets.

A Weekend Effect has already been documented on the JSE by Bhana (1985). Further studies on the JSE have been documented in this chapter. From these studies it can be determined that the JSE does not differ from other international markets - it also has a seasonal pattern in share index returns, which has yet to be adequately explained.

2.8 Recent Developments - Intraday returns

Harris (1986) extended earlier day of the week studies further by considering **intraday price patterns** on individual shares listed on the NYSE. Intraday share price studies are an investigation of price movements within the trading day. He noticed that there are weekday differences in the pattern of intraday returns within the first 45 minutes of trade. Mean returns were far higher in magnitude during the opening and closing periods. Yadev and Pope (1991) found a similar pattern in the U.K. share markets. In the middle of the trading day, no such weekday differences were apparent. It appears that even within daily trading periods, prices do not accrue at equal

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[40]The tests were complex due to J & W having to adjust for differing settlement delays in the foreign exchange markets and the share markets. J & W considered the problem from an American viewpoint - that is as an American investing in foreign share markets, and the foreign exchange seasonal and share market seasonal that such an investor would face.

rates. This tends to contradict the trading time hypothesis[41]. Harris did consider whether these seasonalities contradicted the efficient market hypothesis, and came to the conclusion that they didn't. This was because as soon as trading costs are taken into account, a profitable trading strategy is not possible[42].

Yadev and Pope (1991), presented a paper to the European Finance Association dealing with intraweek and intraday seasonalities in share market risk premia. Their paper contributed to the study of seasonalities in several new directions. All previous studies had investigated total returns, while Yadev and Pope analyze seasonalities in ex post realised **risk premia**. The researchers point out that the study of total share returns may depend , at least partially, on the level of the risk-free rate of interest. They argue that returns should be equal for all days of the week, if the interest component is deducted from observed returns. Such an adjustment eliminates the settlement period effect[43]. In addition, Yadev and Pope, studied intraday seasonalities in the U.K. market and found that prices tended to rise systematically during the first hour of trade. This observation is consistent with the U.S. market (Harris,1986). They also documented a systematic fall in share prices between 2p.m. - 3p.m. This could be due to the opening of the U.S. market and the added uncertainty as to what will happen in this market. However, this appears unlikely, since such a negative return was also documented between 2p.m. - 3p.m. in the U.S. market. It appears that yet another anomaly exists in the share markets!

Unfortunately such a study on the JSE is not be possible due to the lack of data. The only database available is on the closing values of the All Share Index, Industrial Index and the Gold Index. No intraday data is available, and the opening value of the index is not available.

2.9 Summary of Chapter Two

The history of share markets shows that prices fluctuate widely

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[41]The trading time hypothesis assumes that returns are generated during trading time. Thus returns should, on average, be generated at the same rate during trading time. However, Harris' research shows that there is a striking difference between Monday and the other weekdays in the first forty five minutes of trade. Mondays mean return in the first forty five minutes is significantly negative, while on the other weekdays it is significantly positive.

[42]None of the research documented an example of a profitable trading strategy once trading costs are accounted for.

[43]It should be noted that while Yadev and Pope study ex post realised risk premia, several other researchers had already made adjustments for the settlement period effect. The contributions of these other researchers in the field of settlement effects has already been documented in this chapter.

over time. At least part of the reason for these price changes is that new information arrives, and investors re-assess share values based on this information. Whether share prices adjust quickly or correctly to this new information is a question that has received particular attention. The efficient market theory holds that prices instantaneously reflect all available new information. The theory is sub-divided into three levels of efficiency based upon the type of information that is available to the potential investor. These three forms of efficiency are the weak form, the semi-strong form and the strong form. The classifications depend upon the level of information that might be utilised to earn excess returns.

Weak form efficiency states that one cannot earn excess returns by utilising historical information. This implies that technical analysts are wasting their time by investigating charts depicting seemingly regular share price patterns.

In an efficient financial market, costless[44] trading policies will not generate excess returns. Clearly, any regular price pattern which can be exploited to produce consistent excess returns, after taking trading costs into account, would contradict the efficient market hypothesis. However, seemingly regular return patterns have been documented and have come to be known as seasonalities. One of these seasonalities is the Weekend Effect and forms the basis of this study. These returns have all been based on some particular time period. The word "appears" is used, because it may be that the time period does earn above average returns, BUT there may be a logical reason for this "excess" return - for example, dividends are declared by most companies in July, giving rise to an increase in price in that month. Thus the apparent "excess" return can be explained by the price now going cum-dividend[45]. A variety of explanations for the Weekend Effect were presented in Chapter Two.

The study of returns automatically implies a time period. A return on an investment is always related to the period of the investment. Thus the generation of share returns is integral to any study involving returns. This particular study focuses on the mechanism by which share returns are generated. Two basic hypotheses have been developed. The trading time hypothesis which states that the share returns are only generated while the market is open, while the calendar time hypothesis asserts that share

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[44]Costless trading policies imply that there are no transaction costs. There are additional costs in the form of gathering information - direct costs, such as computer systems (i.e. Reuters, I-Net), newspapers etc. and indirect costs, such as the opportunity cost of the time spent gathering information.

[45]If a share trades cum-dividend it implies that the purchaser will receive the declared dividend. However, the trade will be after dividend declaration date, and thus the share will already have the announced dividend factored or built into its' share price.

returns are generated over time - irrespective of whether the market is open or closed.

Seasonalities in share market returns were discovered as early as 1930. Studies indicate that returns are not consistent the calendar hypotheses. There is some evidence that returns are generated in trading time. One characteristic common to all of these studies is the negative Monday return. An extension of this phenomenon was the above average returns, generally observed on Fridays. This would appear to contradict all logic - one would expect investors to sell shares on a Friday, rather than hold over the weekend when events could unfold that may have a negative impact on share prices.

Consequently, the study of negative Monday returns was extended to become the study of the **Weekend Effect**. However, some controversy still exists as to whether the Weekend Effect is simply a part of the closed market effect. The closed market effect includes studies relating to all market closings, and includes the Weekend Effect and the Public Holiday Effect.

Regardless of the name that one attaches to this anomaly, it still appears to contradict the efficient market hypothesis. For this reason new studies appear to have shifted their focus. The researchers tried to find explanations for the anomaly. Several explanations were documented, but none appeared to fully explain the existence of the Weekend Effect. Among the explanations are two that are particularly applicable to the JSE. These are the interest effects of settlement delays and dividend effects.

International studies go on to consider exactly when these excess returns accrue. Is it during trading time, or non-trading time? Contradictory results were obtained. Rogalski's (1984) results indicate that the negative return accrues over the non-trading weekend. Harris (1986) documented that for large firms the negative return accrues over the weekend, while for small firms the negative Monday return accrues during trade on Monday. Yadev and Pope (1991) found that returns on the London Stock Exchange accrue during trade on Monday.

Unfortunately such a study is not possible on the JSE due to the lack of data regarding the opening levels of the indices and the intraday values of the indices.

The chapter concludes with a summary of the most recent developments in the study of seasonalities. These developments relate to research on intraday returns on share indices. In addition the chapter discusses where this study will improve on previous studies, and compares the JSE with research on international share markets.

CHAPTER THREE

ECONOMETRIC MODEL AND DATA SET

3.1 Introduction

This chapter deals with a description of the data and the econometric models used to analyse this data. The data set consists of the daily closing values of the All Share Index, Industrial Index and the Gold Index for the period 26 February 1986 - 29 September 1993. As has been mentioned, previous South African (and several international) studies have only considered an "all share" index. This is the first time that an industrial and gold index are separately analysed and compared to the "all share" index. Apart from the obvious advantage of gaining an insight into the previously unstudied industrial and gold indices, it allows assessment of the impact these "sub" indices have on the all share index.

The econometric models are similar to those that have been employed by other researchers in international studies. This has the advantage of making the results directly comparable to international findings. In this manner the study can be used to address the similarities or differences between international findings and the JSE.

This chapter defines return, and describes the manner in which returns on the indices are calculated. These returns are be analysed for the whole study period as well as for sub-periods. A risk-adjusted return is explained and discussed. The calendar and trading time regression equations originally used by French (1980) are explained in the context of the JSE. In addition, econometric models are presented which adjust for settlement delays and dividend effects.

However, before commencing on the study of any indices, one needs to be aware of the "workings" of such indices. The analysis of the indices includes the objectives of indices, a brief review of the development of the indices, and their calculation. These topics are now discussed.

3.2 History of the indices

1 November 1978 saw the launch of the JSE Actuaries Equity Indices. These were to replace the Rand Daily Mail (RDM) Indices, and thus, for the sake of continuity, the Actuaries' Indices opening levels were linked to the RDM Indices. In addition the Indices were re-calculated back to 1960. Consequently there are thirty three years (1960 -1993) of data available, but unfortunately only the last five years of data is stored on computer. It is for this reason that Bhana's study only included five years of data, (1978 - 1983) and this study only includes

seven and a half years of data. (1986 - 1993). In this study, it has been possible to include an extra two and a half years of data, since the database has been enhanced. However, this is an advantage of the study, since the combination of the two studies' results yields a net twelve and a half year study period. The longer study period will align more closely with international studies[1]. It is true that there is a three year gap between the two studies, but the combined studies imply a gross fifteen year study period (1978 - 1993), with twelve and a half of these years being subject to similar statistical analysis.

3.3 Objectives of the indices

The **primary** objective of an index

> "is to provide a standard against which portfolio performance can be measured objectively." (JSE Actuaries Indices 1993)

It is interesting to note that the All Share Index has outperformed six out of eight SA unit trust investment funds over the last fifteen years. The All Share Index has returned 26,6% annually on average, while the funds have ranged from a low of 22,3% to a high of 28,2%. [The Star 9/5/93 - Quoting statistics from studies performed by Dr Lampbrechts.] (These statistics certainly lend credibility to the recent introduction of Index Funds in South Africa[2].)

In addition there are several **secondary** objectives:

- to provide a description of the market at a point in time in terms of price levels, dividend yields and earnings yields.
- to provide investors with more sophisticated tools to manage their risk exposures, e.g. futures and option contracts based on the indices.
- to provide data to facilitate equity research.
- to provide a yardstick against which portfolio performance can be measured.

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[1]International studies, discussed in Chapter Two, have been based on up to thirty years of data.

[2]The objective of an Index Fund is to match the returns of a underlying index. To achieve this the portfolio of shares in the fund must match the shares included in the index. It is vitally important that the percentage weighting of a share in the index is the same as its percentage weighting in the Index Fund. In this manner the returns on the Index Fund would match the underlying index. This objective differs from that of unit trust investment funds which seek to "beat" the market. This implies that the returns on the fund exceed the returns on the underlying index. The higher returns are, according to the investment funds, generated through the expertise of their investment managers.

3.4 Calculation of the indices

The indices are calculated using a weighted arithmetic average method. This is achieved by selecting a representative sample of JSE shares. Shares selected should be representative in terms of both the direction of movement of the market, and the magnitude of such movements. The selection of the index constituents is primarily based on market capitalisation[3]. There are other qualifying criteria which are discussed in detail in the JSE Index Bulletin. However, one of the more important guidelines for inclusion relates to the tradeability of the shares. Selection of shares that have a low "number of traded shares to number of issued shares" ratio are avoided[4].

The basic procedure for calculating any JSE index, is to list all the shares of each sector in declining magnitude of market capitalisation. Companies are successively selected until approximately 80% of the total market capitalisation of that sector has been included in the index. A weighting procedure[5] then occurs, to ensure that the important shares command a heavier weight in the index.

The share price used in the calculation is the latest transaction price on the date of calculation. If no sale price is available, but a higher buyer's price or lower seller's price is recorded, then this as used. It should be emphasised that fluctuations in share prices (and thus index values) due to dividend declarations are not adjusted for, "as any adjustment would be largely subjective." (Actuarial Index Bulletin, 1993)

This study adjusts for the impact of dividend announcements on the indices. Dividend announcements impact share prices on the last day to register (LDR). In an efficient market one would expect the share price to fall[6] by the present value[7] of the

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[3]Market capitalisation is the product of the companies' share price multiplied by the number of shares in issue of that company.

[4]"Consideration is given to the volume of shares traded when selecting companies. If the proportion of shares traded to total number of issued shares has been exceedingly small over the past few years, the inclusion of the company is avoided if possible." (JSE Index Bulletin, 1993)

[5]Weighting is done by means of market capitalisation. The weighting formulae is detailed in the JSE Index Bulletin.

[6]"After a share has gone ex dividend, the purchaser does not acquire the right to receive the declared dividend, and so the share price drops accordingly" (Board and Sutcliffe, 1988) The share price drops because the purchaser has lost the right to receive a certain future cashflow. A component of the share price, after dividend declaration date but prior to LDR, is for the dividend as this is a certain future cashflow the purchaser

dividend on the day AFTER the LDR. The negative Monday return could be due to the fact that a disproportionately large percentage of shares making up the index have their LDR's on a Friday. This implies that the share prices should fall on Monday by the present value of the dividend declared. Thus the dividend effect may be an explanation of the negative Monday return, but only if a disproportionately large percentage of shares making up the index have LDR's on a Friday. This study needs to determine the frequency of LDR's, for shares making up the indices, across the different weekdays, and make an adjustment for the potential dividend effect. The magnitude of this adjustment should be proportional to the size of the lost dividend (Board and Sutcliffe, 1988). The magnitude of the dividends for a particular index can be obtained from the dividend yield on that index. Thus the adjustment should equal the dividend yield on the index being studied (Solnik, 1990).

3.5 Data set

The data used in this study consists of the daily closing value of the:

i) All Share Index
ii) Industrial Index
iii) Gold Index.

This data was obtained from the Ivor Jones, Roy & Co. Inc. database for the period 26 February 1986 - 29 September 1993. Thus, the data contains one thousand nine hundred and eighty six weekdays. However, during this period, there were a total of seventy six public holidays. The breakdown of the public holidays per weekday is given in Table A:

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is buying and the seller is selling. After LDR the right to this cashflow is not included in the share price, and thus the share price drops by the amount of the declared dividend.

[7]The present value is for the period from the day after the LDR to the actual dividend payment date (i.e. when cash is paid by the company and received by the shareholder).

Table A
Public Holidays in the study period

DAY	NUMBER OF PUBLIC HOLIDAYS
Monday	22 days
Tuesday	9 days
Wednesday	9 days
Thursday	14 days
Friday	22 days
TOTAL	76 days

It is clear from Table A that Mondays and Fridays account for more than half of the public holidays. It is possible that the uneven distribution of public holidays has a significant impact on the Weekend Effect. This possibility is considered at a later stage of the chapter. Thus, there are approximately one thousand nine hundred and ten closing values of the indices. All of the statistical tests are based on these observations.

A problem is encountered on public holidays, since no index value is available. Therefore it is not possible to perform tests for these days, as all of the statistical tests utilise the closing index value, and there is no closing index value for a public holiday. In the first statistical test public holidays are ignored, and the day after the public holiday is compared to the day before the public holiday. For example, if there is a Wednesday public holiday, then it is effectively deleted from the dataset. The Thursday closing index level would be compared to the Tuesday closing index level.

It is useful to break the All Share Index into its components in order to obtain an understanding of the data that is employed. An analysis of the All Share Index shows that the following indices contribute to its make-up:

Table B
Indices Contributing to the All Share Index

Coal Diamonds All Gold Metals & Minerals	0.84% 7.23% 7.21% 4.47%	Mining Prod.	19.75%
Mining Houses Mining Holding	11.99% 4.62%	Mining Fin.	16.61%
Financial Industrial	16.30% 47.34%	Fin & Ind	63.64%
TOTAL	100 %	TOTAL	100 %

Source: Ivor Jones, & Roy Co. Inc.

From Table B, it is clear how the JSE All Share Index is unique in comparison to international share markets, due to the influence of the gold/mining sector. It should be noted that the mining sector contributes 36% (19.75% + 16.61%) towards the All Share Index, while the Financial and Industrial Indices contribute the remaining 64%. For this reason the study analyses the All Share Index, Industrial Index and Gold Index separately. It may be that the Industrial Index displays similar share return patterns when compared to the share return patterns on international share markets. However, gold shares may have atypical behaviour (Bradfield, 1990), and thus the Industrial and Gold Indices should be studied separately. Only once it has been ascertained as to whether gold shares have a unique impact on the All Share Index, will it be possible to comment on the behaviour of the All Share Index in relation to international share markets. (i.e. with regard to the Weekend Effect.)

Appendix A gives a list of the top contributors to the All Share Index. It should be noted that:

- 5 shares make up 28% of the All Share Index
- 10 shares make up 44% of the All Share Index
- 20 shares make up 62% of the All Share Index
- 30 shares make up 74% of the All Share Index
- 50 shares make up 88% of the All Share Index

The above statistics make it abundantly clear how large an influence a small number of shares have on the index. It would almost certainly be possible to influence the level of the index by influencing the prices of the top ten shares. Components of the Industrial Index and Gold Index are also listed in Appendix A. From these lists it is noted that:

- 5 shares make up 96.36% of the Gold Index
- 5 shares make up 36.13% of the Industrial Index

3.6 Limitations of the data

Unfortunately it is not possible to obtain the perfect data set. For this reason it is important that the limitations of the data used in this study are acknowledged. Any future research should be aware of these limitations; moreover they must be taken into account when assessing conclusions. The following limitations are applicable to this data set.

1) Only the closing value of the index is available. There is **no opening value** available for any of the JSE indices. Thus there is no manner to determine whether the negative Monday return accrues over the non-trading weekend, or if it is a characteristic that arises during trade on Monday. Other

international studies[8] have analysed returns from the open-to-closing value of an index on any particular weekday. These studies have allowed the researchers to determine whether the negative return accrues during trade on Monday, or whether it arises over the non-trading weekend.

2) **No intradaily data** on the indices is available. Consequently there is no way in which international intraday studies can be replicated at this point in time. Overseas studies[9] have managed to identify intradaily seasonalities. Without this data it is impossible to determine whether similar patterns exist on the JSE. Intradaily data has allowed other researchers to determine exactly when returns accrue during the day - in particular when the negative Monday return and positive Friday returns accrue.

3) **Only 8 years of data** is available. This is significantly less than some of the overseas studies, which have an average twenty-year period. However, as previously mentioned, this study adds to Bhana's results, and provides a longer study period on the JSE. In addition Bhana's study was based on five years of data, while this study covers an eight year study period - which implies that this study period is 60% longer than Bhana's study. Combining the two study periods yields a thirteen year study period.

4) The JSE is infamous for its **illiquidity**. This has been discussed at length, and it should be noted that this can lead to observed prices not equalling underlying or true prices. However, mitigation of this potential limitation of the data, is made due to the JSE Actuaries Department selection criteria. One of the selection criteria requires that shares included in the indices are regularly traded. Thus shares prices used are likely to be a fair reflection of the underlying or true prices

5) The data consists of the unadjusted closing values of the indices. Thus, the **effect of dividends and settlement delays** on the indices has not been removed. However, this is not a serious limitation, as this study proposes to

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[8]See for example Rogalski (1984) who found that the negative Monday return accrues between the Friday close and the Monday open. In addition, it was noted that the Monday open-to-close return was the same as other days of the week. Harris (1986) found that the negative Monday return accrues over the non-trading weekend for large firms, while the negative Monday return accrues during the trading period on Monday for small shares.

[9]Examples of intradaily studies include: Harris (1986) on New York Stock Exchange data and Yadev & Pope (1991) on U.K. share market data.

adjust for the effect of any dividends[10].

3.7 Econometric models

Most of the econometric models used in this study are a replication of models applied by other researchers on return anomalies in international share markets. This is an advantage since it makes the results of this study comparable to other studies. Thus it is possible to compare and contrast share price patterns found on the South African market to patterns on international markets.

The **first exercise** is to establish a numerical table detailing the number of positive and negative returns[11] that are in evidence on each weekday during the study period. This gives a description of the data set by detailing the number of positive, negative and nil returns for each day of the week. It also helps to give an indication as to whether any of the results obtained are influenced by outliers, since the exercise also details the maximum and minimum returns within the data set. In addition, it indicates if any particular day has an abnormally large number of positive or negative returns. This study employs the same methodology as that used by Cross (1973) and French (1980).

The **second exercise** calculates the daily returns of the indices. Return has been defined and calculated in the same manner as all of the international studies[12], and is merely a comparison of the closing value of the index to the closing value of the index on the preceding day. At this point no adjustment is made for dividends or settlement delays. These form the subject of later exercises in this thesis. Returns are defined as:

$$R_t = \frac{X_t - (X_{t-1})}{(X_{t-1})} * 100\% \qquad \{1\}$$

where:
R_t = Daily return on the index for day t
X_t = Closing value of the index on day t
X_{t-1} = Closing value of the index on the previous day (t-1)

Thus the formula represents the closing value of the index on day X_t, minus the closing value of the index on the previous day (X_{t-1}) divided by the closing value of the index on the previous day (X_{t-1}). The returns are then expressed in percentage form.

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[10]Refer to section 3.7 for a discussion on how dividends are adjusted for.

[11]The method for the calculation of return has been defined in equation {1} below.

[12]The international studies are too long to list. Refer to the bibliography and Chapter Two.

There is no point in analysing returns in isolation. It is also necessary to consider the risk versus reward relationship. It may be that Friday returns are higher than the returns on the other days of the week. However, this may be due to higher risk. The risk of a particular day is measured by the variance[13] in that day's returns. The higher the variance in the returns the more risky the investment. Thus the study needs to evaluate daily returns relative to the daily risk in those returns. Only in 1990 did Ariel considered the risk versus return (reward) relationship in the study of seasonalities. In his study of high share returns before holidays, he adjusted daily returns for the daily variance in those returns. This study performs a similar exercise, and represents the first time that such an adjustment is made in the study of intraweek returns on the JSE. The daily returns should be divided by the standard deviation of that days return so that all days returns have a common variance[14]. If all days have a common variance, and variance is a measure of risk, then all day's returns have the same risk. In this manner risk adjusted returns can be compared, which means that any excess returns on a particular weekday are not a reward for bearing extra risk. If all of the returns have a common variance, they can be compared on the same risk basis. Thus the returns are adjusted for risk. The following equation serves to illustrate the statistical procedure that will be performed.

$$\text{Risk adjusted return} = R_t/\text{S.D.} \qquad \{1a\}$$

where:
R_t = as defined in equation {1}.
S.D. = Square Root of the variance of the daily returns.

The evaluation needs to remove large "outliers" from the sample, to avoid possible distortion in the results[15]. An additional item considered is the elimination of Friday the 13th returns. It is possible that the returns on these days are abnormal in some

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[13]Variance is a measure of how much returns change over a period of time. The larger the percentage change in returns, the larger the potential loss or reward. Associated with the large changes in returns is risk. Variance is a measure of how much returns change over a time period. As such variance is a measure of risk.

[14]Per consultation with Prof. Wegner (UCT Statistical Sciences Department). This manipulation ensures that returns for each day of the week have a variance of one. Thus all weekdays have the same variance, and hence the same risk.

[15]"Outliers" are data points that are abnormally high or low, and are not representative of the rest of the data set. The outliers may have been caused by some extraordinary factor - an example may be that of the 19 October 1987 "crash". This methodology is used by Yadev & Pope (1991) and is recommended by Bradfield (UCT Statistical Sciences Department).

manner due to possible phycological effects on this day[16]. It is possible that potentially abnormal returns on these days will impact on the statistical analysis.

The **third exercise** replicates French's (1980) tests. Bhana (1985) performed a similar test. This exercise establishes whether there have been any significant changes with respect to the trading and calendar time hypotheses in the last ten years. These are expressed by the following regression equations:

Trading Time -

$$Y' = A + B_2D_2 + B_3D_3 + B_4D_4 + B_5D_5 + E \quad \{2\}$$

where:

Y'= Return on the index being studied.

A = Expected return for Monday.

B_2, B_3, B_4, & B_5 represent the difference between the expected return for Monday and the expected return for each of the other days of the week.

D_2, D_3, D_4, & D_5 represent dummy variables for Tuesday, Wednesday, Thursday and Friday. If the observation falls on a Tuesday, then $D_2 = 1$. If the observation does not fall on a Tuesday, then $D_2 = 0$. The same applies for the other weekdays.

E = Disturbance factor.

The trading time hypothesis assumes that returns are generated only during trading time. All days of the week have an equal period of trading time and thus all days of the week should have equal returns. The above regression equation tests whether Monday's return is equal to all of the other weekdays by studying the difference between Monday's returns and the other weekdays returns. If Mondays returns are equal to the other weekdays returns, then B_2, B_3, B_4, & B_5 will all be close to zero and an F-statistic measuring the joint significance of the dummy variables should be insignificant (French, 1980). If the F-statistic is insignificant then we can conclude that returns are indeed generated only during trading time.

Calendar Time -

$$Y' = A(1+2D_1) + B_2D_2 + B_3D_3 + B_4D_4 + B_5D_5 + E \quad \{3\}$$

where:

D_1 = Dummy variable for Monday. (ie $D_1 = 1$ if the observation falls on Monday, otherwise it is = 0.)

A = One-third of the expected return for Monday.

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[16]It is widely believed by the superstitious that Friday the 13th is an unlucky day. It is possible that this belief will affect share returns in some abnormal manner. In order to address this possibility, returns for these day are omitted in an exercise to determine if Friday the 13th has any abnormal effect on share returns. This procedure is the same as that adopted by Bhana (1993), who states that "in a class by itself - almost considered an antithesis of a holiday by the superstitious - is Friday the 13th".

B_2, B_3, B_4, & B_5 represent the difference between one-third of the expected return for Monday and the expected return for each of the other days of the week.
Other variables = as per equation {2}

The calendar time hypothesis assumes that returns are generated during calender time, and thus Monday represents a three calendar day investment. For this reason, returns must be three times larger on Monday to compensate for the longer calendar time investment. Thus regression {3} tests if Monday's return is equal to the returns of the other days of the week, after the necessary adjustment of dividing Monday's return by three.

The calendar and trading time hypotheses are tested by means of the regression equations described above. These equations are identical to those used by, amongst others, French (1980) and Bhana (1985).

The **fourth exercise** involves adjusting the daily returns for the effects of settlement delays. This means adjusting for interest rate effects in settlement period asymmetries. The following formula is used to adjust the daily returns for the effects of settlement delays[17]:

$$\text{Adjusted Return} = R_t - y \qquad \{4\}$$

where:
R_t = Daily return on the index as defined in equation {1}
y = Daily risk free interest rate

On 30 May 1991, the settlement period changed from fourteen business days to seven business days.

With **no public holidays** the returns prior to 30 May 1991 are adjusted as follows:

Table C
Fourteen Business Day Settlement Period

Share Purchase Date	Settlement Date	Number of days
Monday 1st	Thursday 18th	18 days
Tuesday 2nd	Friday 19th	18 days
Wednesday 3rd	Monday 22nd	20 days
Thursday 4th	Tuesday 23rd	20 days
Friday 5th	Wednesday 24th	20 days

Table C, reveals that purchasers on Wednesday, Thursday or Friday have an extra two days in which to settle their payment for shares. Thus the purchaser obtains an extra two days of interest-

[17]The same methodology is employed by Lakonishok & Levi (1982).

free credit from the seller. It is hypothesised that the rational investor adjusts share prices for these two days of interest-free credit. Therefore, index values on Wednesday, Thursday and Friday should also be adjusted downwards for two days of interest. The adjustment of index values downwards on Wednesday, Thursday and Friday is equivalent to adjusting Wednesday **returns** downwards and Monday **returns** upwards by two days of risk-free interest. This is because returns, as defined in equation {1}, are a comparison of the closing value of the index to the preceding day's closing index value[18].

The next step is to choose which interest rate should be used to adjust the returns on the indices. The risk-free interest rate is the appropriate rate to use. Lakonishok & Levi (1982) used the prime rate as their risk free interest rate. Theobald & Price's (1984) article does not make it clear as to what they use as their risk free interest rate. Dyl & Martin (1985) use the overnight federal funds rate to adjust for settlement effects. Jaffe & Westerfield (1985) and Board & Sutcliffe (1988) adjust for interest effects in another manner. They do not adjust returns by an interest rate, but calculate what implicit rate of interest would result in returns being equal across the different days of the week[19]. This study adopts the approach taken by Lakonishok & Levi, since there are several factors that could impact on returns across weekdays. Thus, it is more appropriate to adjust the returns for interest effects, rather than to compute an implicit interest rate. In this study the Bankers Acceptance Rate (BA Rate) is used. This is obtained on a daily basis for the period under review.

Table D
Seven Business Day Settlement Period

Share Purchase Date	Settlement Date	Number of days
Monday 1st	Tuesday 9th	9 days
Tuesday 2nd	Wednesday 10th	9 days
Wednesday 3rd	Thursday 11th	9 days
Thursday 4th	Friday 12th	9 days
Friday 5th	Monday 15th	11 days

Table D indicates how the more recent seven business day settlement period impacts on receipts and payments. Buyers now

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[18]An alternative procedure is to adjust Monday and Tuesday index values upwards by two days of interest, but all previous studies have adjusted returns - for example Lakonishok & Levi (1982) and Theobald & Price (1984).

[19]Note that this approach has its problems, since it assumes that all differences in weekday returns are caused by interest effects. The longer and more correct approach is to adjust returns by the risk free interest rate.

find that only Friday purchases result in an extra two days of interest-free credit. This has been caused by a weekend falling between purchase date and settlement date. Presumably, rational investors factor the extra two-day interest-free settlement into the price of the shares. For this reason any analysis should adjust Friday returns downwards by two days of risk-free interest, and Monday returns upwards by two days of risk-free interest.

It is noted that in order to adjust for settlement delays, returns must be adjusted downwards by the number of extra interest-free settlement days there are for purchasers. The data are sub-divided into two periods:

(1) prior to 30 May 1991: Wednesday returns to be adjusted downwards and Monday returns to be adjusted upwards by two days of risk free interest.

(2) after 30 May 1991: Friday returns to be adjusted downwards and Monday returns to be adjusted upwards by two days of risk free interest.

It should be noted that the above analysis fails to take into account the effect of **public holidays.** Public holidays have a complex impact on the settlement procedures. This is illustrated with an example of a Wednesday public holiday, combined with a seven day settlement period:

Table E
Public Holidays and a seven day settlement period

Share Purchase Date	Settlement Date	Number of Days
Monday 12th	Wednesday 21st	10 days
Tuesday 13th	Thursday 22nd	10 days
Wednesday 14th	N/A	N/A
Thursday 15th	Friday 23rd	9 days
Friday 16th	Monday 26th	11 days

From Table E it can be seen how public holidays impact on the settlement procedure for trades up to a week before the public holiday. In fact the holiday on Wednesday 14th causes shares purchased from Tuesday 6th to Tuesday 13th to have one extra settlement day. Thus public holidays cause settlement delays to be altered in a more complex manner. In theory adjustment for the settlement delays caused by public holidays is required. However, for the purposes of this paper, public holidays are not adjusted for, since it is considered unlikely that the average investor would adjust share prices for public holidays which occur on a

random basis[20].

The **fifth test** examines the effects of dividends. As discussed previously share prices, in theory, drop by the amount of the dividend after the LDR. If company's LDR's do not fall randomly on the five weekdays, it could lead to an inequality in returns across the days of the week. Previous South African studies have not researched this possibility. Most have recognised that dividends do have an impact on share prices. However, in order to adjust for the effects of dividends, they simply subtract the average dividend yield from the daily returns. This procedure assumes that companies LDR's fall randomly across weekdays. This assumption may be at odds with economic reality. In fact, it appears to violate le Wet's (1992) observation that most companies' LDR's fall on a Friday.

This study proposes to determine the daily distribution of LDR's for shares forming the All Share Index. Only in this manner that is it possible to adjust daily returns for the effects of shares going ex-dividend. This process determines on which days shares forming the All Share Index have their LDR's. However, for simplicity, only shares forming 75% of the index, i.e. the top 40 shares, are considered. On this basis the study can determine if shares have their LDR's on a particular weekday. If it is found that the LDR's fall on a particular weekday, then it is necessary to adjust the returns of the day after LDR upwards by the amount of the dividend yield on the index. This methodology is used by Board and Sutcliffe (1988) and Solnik (1990).

The **sixth exercise** evaluates the impact of the bid-ask bias in the pricing of index constituents. The closing price is the price at which the share last traded, except when there has been a lack of activity, in which case there may be cause to use the bid price or the ask price. It is possible that the use of ask prices on a Friday would lead to an increase in the returns for Fridays. However, use of bid prices on a Monday may lead to a decline in the returns for Mondays.

This possibility is investigated by taking a selection of Fridays and Mondays. For the days selected, the study determines what price was used for a number of shares making up the indices - was it the last trade price, bid price or ask price? This allows one to make a judgement as to whether there is a bid-ask bias causing inequality in returns across days of the week.

The **seventh exercise** addresses various statistical assumptions about the data. This test will not be performed in isolation, but is rather addressed as each of the other tests is undertaken. More discussion about this topic is presented as each of the tests is performed in Chapter Four.

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[20]It should be remembered that in this example we have looked at a seven day settlement period. When there was a fourteen day settlement period, the returns would in theory be affected for up to two weeks before the public holiday.

The eighth exercise cannot be performed in isolation, since it involves almost all of the previous tests. In fact, this exercise is performed in conjunction with each of the previous exercises. It is simply a commentary on the differences or similarities between the results of the All Share Index, Industrial Index and Gold Index. This may have implications for tradeability, as one index may be more tradeable[21] in comparison to the other indices. It is emphasised that this is the first time that indices other than the All Share Index have been subject to empirical analysis. This represents an important contribution to the existing body of knowledge, since nothing is known about day of the week effects on the Industrial Index and the Gold Index. It will be interesting to ascertain as to whether the indices display identical return patterns, or whether there are significant differences between return patterns.

All of the previous exercises have adjusted for various potential explanations of the weekend effect in isolation. These studies are important, since they show what portion of the Weekend Effect can be explained by each of the potential explanations. However, all of these factors work simultaneously in a dynamic environment. This is an area in which this study proposes to improve upon previous studies. This study performs a test where **all of the adjustments are performed simultaneously.** It is possible that the Weekend Effect is a result of a number of factors working in combination. It may be that when all of these factors are adjusted for in one test, then the Weekend Effect disappears - that is, if a Weekend Effect is in existence in South Africa.

3.8 Summary of Chapter Three

The chapter began by giving a brief history and discussing the objectives of the indices. Indices are calculated using a weighted arithmetic average. This means that shares are listed in order of market capitalisation, and the top 80% of each index is selected. These shares then form the basis of the indices. The chapter then becomes more specific and focuses on the data used in this study. The data consists of the daily closing values of the All Share, Industrial and Gold Indices for the period. The various limitations of this data are then highlighted. The two main limitations are that there is no intradaily or opening index values available.

Once the shortcomings of the data have been discussed, the tests to be performed are briefly explained. These tests can be summarised as follows:

1. a.) Number of positive and negative returns for each weekday, for each index.
2. a.) Daily returns on the All Share Index, Industrial Index and Gold Index.

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[21]One index may be composed of shares that are traded more frequently, in comparison to the other indices.

b.) Daily returns relative to the daily variance of these returns.

3. a.) Trading Time Hypothesis.
   b.) Calendar Time Hypothesis.
4. a.) Adjusting returns for settlement delays.
5. a.) Adjusting for the effects of dividends.
6. a.) Adjusting for the effects of the bid-ask bias.
7. a.) Addressing the statistical assumptions in the previous tests.
8. a.) Comparison of the three indices on all the tests performed.
9. a.) Adjusting for all influencing factors simultaneously.

Most of these tests are based on the same methodology used by international researchers. This approach is useful since the results of this study can be compared to international findings. Thus daily share return patterns on the JSE can be compared to share return patterns on other international share markets.

CHAPTER FOUR

EMPIRICAL RESULTS AND ANALYSIS

This chapter deals with a discussion of the data used in the study, and an analysis of the results obtained from the tests described in Chapter Three.

The database consists of the closing[1] values of the All Share Index, Industrial Index and Gold Index from 26 February 1986 to 29 September 1993. Thus there are one thousand nine hundred and eighty six weekdays. However, during this period, there were a total of seventy six public holidays on which the JSE was closed and no index value is available. The public holidays have been detailed in Chapter Three, Table A. Thus there are a total of one thousand nine hundred and ten closing values of the indices, on which the statistical tests are based.

4.1 Number of positive and negative returns on each weekday

The first test is to establish the **number** of positive and negative returns for each day of the week for each of the indices. This task was performed using Lotus software. Returns were calculated by performing equation {1} detailed in Chapter Three. (As a reminder, the calculation involves dividing the difference between todays' closing value and yesterdays' closing value, by yesterdays' closing value. For example, Monday's closing value would have Friday's closing value deducted from it, and the difference would be divided by the closing level of the index on Friday.)

A problem is encountered with public holidays, since markets are closed and no index value is available. Thus it is not possible to perform tests for these days. In the first exercise public holidays are ignored, and the day after the public holiday is compared to the day before the public holiday. For example, if there was a Wednesday public holiday, then it is effectively deleted from the dataset. Thursday's closing index level is be compared with Tuesday's closing index level. This approach is used by French[2], and results of this study are presented in Table

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[1] The closing value is defined as the value of the index as calculated by the JSE Actuaries department from share prices at 16.00H on a daily basis.

[2]As with French (1980), the tests were reperformed by omitting any returns for a period that includes a holiday. In the above example, the Thursday return would have been omitted from the dataset. The t-statistic results of this test are presented in Table L. The returns are recorded in Appendix B and are almost identical to those presented in Table F. (The process of omitting

F:

Table F
Results from first test on the Indices
Number of Positive, Negative and Nil Returns

DAY	ALL SHARE			INDUSTRIAL			GOLD INDEX		
	+VE	NIL	-VE	+VE	NIL	-VE	+VE	NIL	-VE
Monday	175	10	189	176	17	181	175	6	193
Tuesday	207	6	175	218	11	159	187	9	192
Wednesday	216	6	167	227	12	150	201	7	181
Thursday	206	10	167	227	8	148	187	4	192
Friday	191	9	175	198	20	157	167	8	200
TOTAL	995	41	873	1046	68	795	917	34	958

Table F is set out in the following manner. The first column for each of the indices shows the number of positive returns, the second column shows the number of nil returns and the third column shows the number of negative returns. For example, on Monday, reading from left to right in Table F, there were a total of one hundred and seventy five positive returns, ten nil returns and one hundred and eighty nine negative returns on the All Share Index.

The first point to note is that the number of nil returns appear to show no particular pattern across the days of the week. For this reason, they can be dismissed as having no material impact on the study of intraweek returns. (If anything, there tend to be a greater number of nil returns on Mondays and Fridays.)

It will be noticed that on all of the indices, there are a larger number of negative returns than positive returns on Mondays. For the All Share and Industrial Indices, there are a larger number of positive returns than negative returns on the other four weekdays. This is the first indication of the negative Monday phenomena. It is interesting to note that the Gold Index has a larger number of negative returns on all days of the week, except Wednesdays. It would appear as if the Gold Index exhibits atypical behaviour when compared to the All Share and Industrial Indices. In addition the total number of positive returns exceed the total number of negative returns on both the All Share and Industrial Indices. However, the converse is true for the Gold Index. The number of positive returns on the All Share Index exceed the negative returns by 14%. However, with the Industrial Index, the percentage increases to 32% - over double. There can be little doubt that this is due to the influence of the gold

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post holiday returns is common to the methodology used by French (1980) and Harris (1986).)

shares on the All Share Index. From this observation we should note the vast influence that gold shares have on the All Share Index. For this reason the JSE All Share Index may display atypical behaviour when compared to other international indices. Thus, it may be more meaningful to compare the Industrial Index (and not only the All Share Index) to international indices. It may lead to closer comparisons, since the Industrial Index is free from the effects of the Gold Index, which is unique to South Africa. In addition, some of the international studies[3] are conducted on their industrial indices, and not their all share indices.

The results of test one can be summarised as follows:

- Nil returns appear not to exhibit any particular pattern across different weekdays.
- On the All Share and Industrial Indices, the number of positive returns exceed the number of negative returns on all days, EXCEPT Mondays.
- The Gold Index shows the number of negative returns exceeding the number of positive returns on all days, except Wednesdays.
- The Gold Index appears to show atypical behaviour, and thus it may be more meaningful to compare the JSE Industrial Index to the international indices - due to the influence of gold shares on the All Share Index.

4.2 Calculation of average returns for each weekday

The second test involves the calculation of returns on a day to day basis. This test yielded the following results on the indices:

Table G
Second test - Average returns on the indices

DAY	OBSERVATIONS	ALL SHARE	INDUSTRIAL	GOLD
Monday	374	-0,03706	-0,06324	0,091043
Tuesday	388	0,025965	0,090197	-0,09678
Wednesday	389	0,162345	0,162766	0,138515
Thursday	383	0,101329	0,131432	0,027792
Friday	375	0,048466	0,056678	0,039607
TOTAL	1909	0,060948	0,076612	0,039950

The first point to note is the lower number of Friday and Monday observations, as can be seen in the second column of Table G. This is explained by the larger number of public holidays on

[3]For example Fields (1931), and Rogalski (1984) conducted their studies on the Dow Jones Industrial Average.

these two days, which can be observed in Table A of Chapter Three. The information contained in Table G is presented in bar graph format below, (see Graph 1) since it gives a clearer visual display of the information.

GRAPH 1

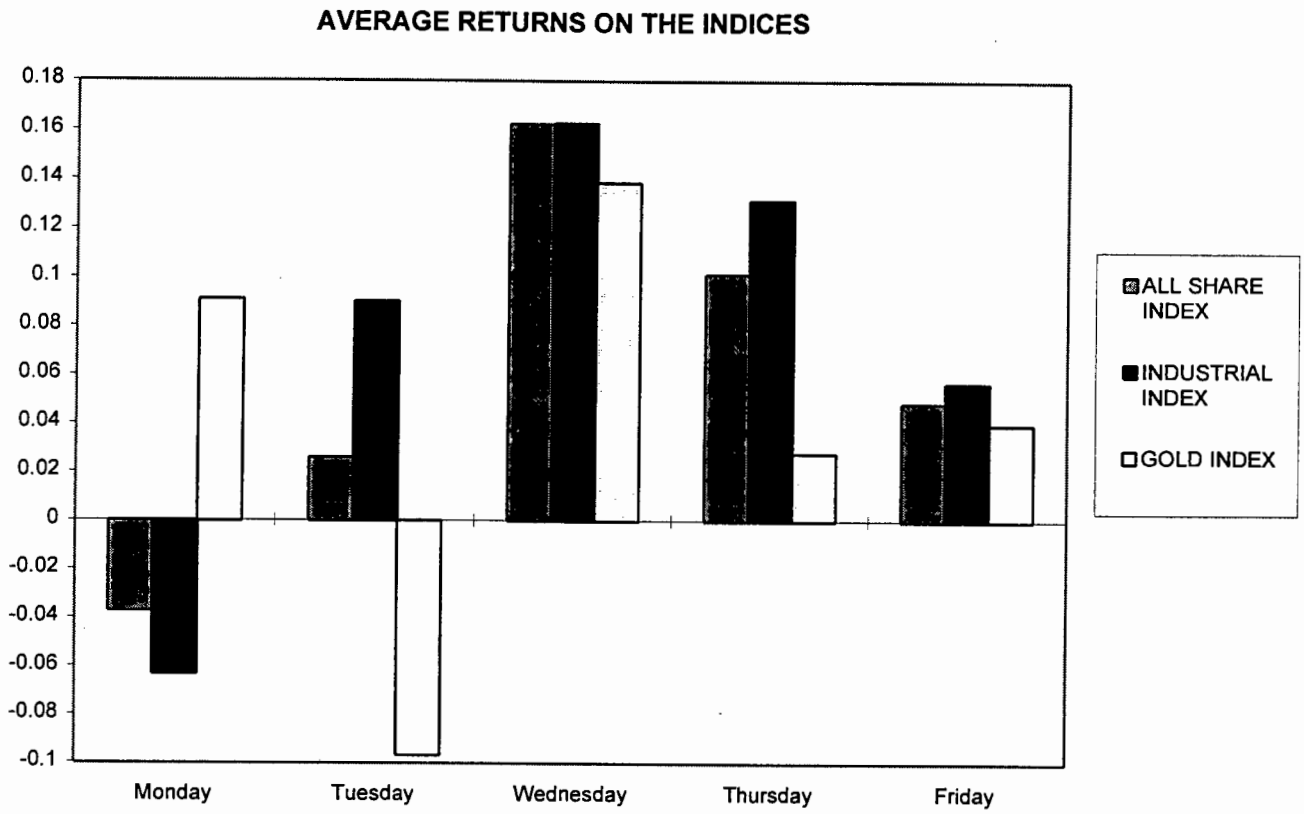


Table G and Graph 1 clearly indicate the negative Monday return, on the All Share and Industrial Indices. It is interesting that there appears to be no abnormally high Friday return, as was observed in most of the international studies. Instead, the highest return is observed on Wednesdays. In fact, Friday's return ranks after both Wednesday and Thursday. Thus the negative Monday return is present, but the high Friday return has shifted to Wednesday. These results are consistent with Bhana's (1985) study on the All Share Index for the period 1978 - 1983. Thus the pattern of returns across weekdays has not changed over the last fifteen years. Wednesday still has the highest return followed by Thursday, Friday and Tuesday. Monday has the only negative return.

The high Wednesday return is not unique, since it was noted in a few of the international studies. Although French (1980) makes

no comment, his results on the S & P composite portfolio indicate that Wednesday's returns are significantly positive at the 0.5% level and Thursday's returns are significantly positive at the 5% significance level. Lakonishok and Levi (1982) note "an additional puzzling result is the abnormally high returns on Wednesdays for the entire period and earlier subperiods." Board and Sutcliffe's (1988) study of the Financial Times All Share Index shows that Wednesday's returns are significantly positive at the 1% level.

Again the atypical behaviour of the Gold Index is noted - the lowest return is on Tuesday, and not Monday. Tuesday is also the only day of the week which has a negative return. This is very clearly illustrated in Graph 1. It is interesting to note that despite the Gold Index having a larger **number** of negative returns (see Table F), the average return per day of the week is positive - (except on Tuesdays.) Another anomaly with the Gold Index is that not only is Monday's return **not** negative, but it is also the second highest return of the week! In the case of the Gold Index, it appears as if the Monday effect has shifted to Tuesday. Studies on the S & P composite, Dow Jones Industrial Average and Financial Times All Share indices all show Tuesdays having a positive return. The negative Tuesday return on the Gold Index has been observed in other international studies. For example, Jaffe and Westerfield (1985) comment "In one respect, the data are different from previous studies of daily seasonals. The lowest mean returns for both the Japanese and Australian indices occur on Tuesday. The average Tuesday return for both these countries is significantly different from the overall average return on the other days of the week. This phenomenon is puzzling since it is not found in past studies on the U.S., and we do not observe it for either Canada or the U.K." Board and Sutcliffe (1988) note on the study of the Financial Times All Share Index that "it is interesting to note that, although U.S. treasury bills show a Weekend Effect, ... U.K. gold returns do not." A later study performed by Solnik and Bousquet (1990) on the Paris Bourse showed "a strong and persistent negative mean return on Tuesday."

What is common between the All Share, Industrial and Gold Indices is that the highest return occurs on Wednesdays.

Thus the results of test two can be summarised as follows:

- Negative returns are witnessed on Monday for the All Share Index and Industrial Index. This correlates with international observations of a negative Monday return. However, negative returns are observed on Tuesdays in the case of the Gold Index. The Gold Index appears to exhibit atypical behaviour.
- All indices display the highest return on Wednesdays, which appears to contradict international studies - showing their highest returns on Fridays. It seems that there is no Weekend Effect on the JSE.
- The returns on the Gold Index are, on average, substantially lower than the All Share and Industrial

Indices.

4.3 Returns - pre and post SAFEX introduction

It is interesting to sub-divide the study period into the time before the introduction of the South African Futures Exchange (SAFEX), and the period after the introduction of SAFEX. SAFEX came into operation on 1 April 1990. Thus daily returns on the indices are evaluated for the period prior to 1 April 1990, and the period after 1 April 1990. The results are as follows:

Table H
Daily returns on the indices - pre & post introduction of SAFEX

	ALL SHARE		INDUSTRIAL		GOLD	
	PRE	POST	PRE	POST	PRE	POST
Monday	-0.0799	0.01378	-0.080	-.04	-0.48	0.256
Tuesday	0.04103	0.00763	0.0777	0.11	0.014	-0.23
Wednesday	0.23202	0.07535	0.2120	0.10	0.196	0.069
Thursday	0.13311	0.06193	0.1662	0.09	0.074	-0.029
Friday	0.09700	-0.0101	0.0754	0.03	0.077	-0.005

In Table H, **PRE** indicates returns on a daily basis for the period 26/2/86 to 1/4/90, while **POST** indicates the period after the introduction of SAFEX (ie 1/4/90 to 29/9/93). It will be noted that prior to the introduction of SAFEX, all indices displayed a negative Monday return and positive returns for the other days of the week. The negative Monday return is well documented on the international markets. Thus it appears as if the indices behaviour on Mondays, prior to the introduction of futures in South Africa, was the same as the international markets. However, it was only common as regards the negative Monday return. There is no Weekend Effect, since there is no high Friday return. There is evidence of a Midweek Effect, as Wednesdays appear to exhibit abnormally high returns in comparison to the other weekdays.

After the introduction of SAFEX, the pattern of returns across the days of the week change quite dramatically for the Gold and All Share Index. Table H shows that the Industrial Index still has a negative Monday return, while other weekdays show positive returns. In addition the Industrial Index still appears to exhibit a Midweek Effect, with Wednesday being the highest return of the week. However, the pattern of returns for the Gold Index changes quite dramatically. The negative Monday return has disappeared - in fact it is now the largest positive return of the week! Tuesdays, Thursdays and Fridays (in descending order) now show negative returns. Thus after the introduction of SAFEX, the negative return for Mondays has shifted to Tuesdays. In addition, Monday is now the highest return of the week, and Thursdays and Fridays have changed from positive to negative returns. Clearly changes on the Gold Index impact on the All

Share Index. We note that in the **POST** period the negative Monday return on the All Share Index has shifted to Friday, and all of the other weekdays display positive returns. There is still clear evidence of a Midweek Effect.

Sub-division of the database into PRE and POST SAFEX has yielded some interesting observations which can be summarised as follows:

- Prior to the introduction of SAFEX, all indices displayed a negative Monday return. This observation is common to international day-of-the-week studies for U.S. and U.K.
- The introduction of SAFEX had no impact on the pattern of returns for the Industrial Index. However, it had the following effects on the Gold Index:
    1. The negative Monday return shifted to Tuesday.
    2. Thursday and Friday changed from positive to negative returns.
    3. Mondays now display the largest positive return.
- The All Share Index's negative Monday return shifted to Friday. This is due to the impact of the Gold Index.
- PRE and POST SAFEX periods show a Midweek Effect, with Wednesdays having abnormally large positive returns.

From the above, it would appear as if the Industrial Index coincides with international observations of a negative Monday return. However, there appears to be no abnormally high Friday return, but there does appear to be an abnormally high Midweek Effect. The high Midweek Effect has not been noted in other international studies. The Gold Index appears to exhibit atypical behaviour (after the introduction of SAFEX) in comparison to U.S. and U.K. observations, since it displays negative returns on Tuesdays, Thursdays and Fridays. The negative Tuesday return has been documented in studies of the Australian and Japanese share markets. The reasons for this can only be speculated upon, and could form the topic of further studies in this field. (It may be that the Australian market is also influenced by gold shares, and thus the negative Tuesday return is due to a gold market effect. This still does not explain the negative Tuesday return on the Japanese market.)

4.4 Variance of returns for each weekday

However, there is no point in considering returns in isolation. One needs to consider the risk versus reward relationship. It may be that lower returns are associated with lower risk, and that higher returns are associated with higher risk. In this exercise returns need to be adjusted for risk. Risk is measured by means of variability. That is, the more variable a particular day's return, the greater the risk associated with that day.

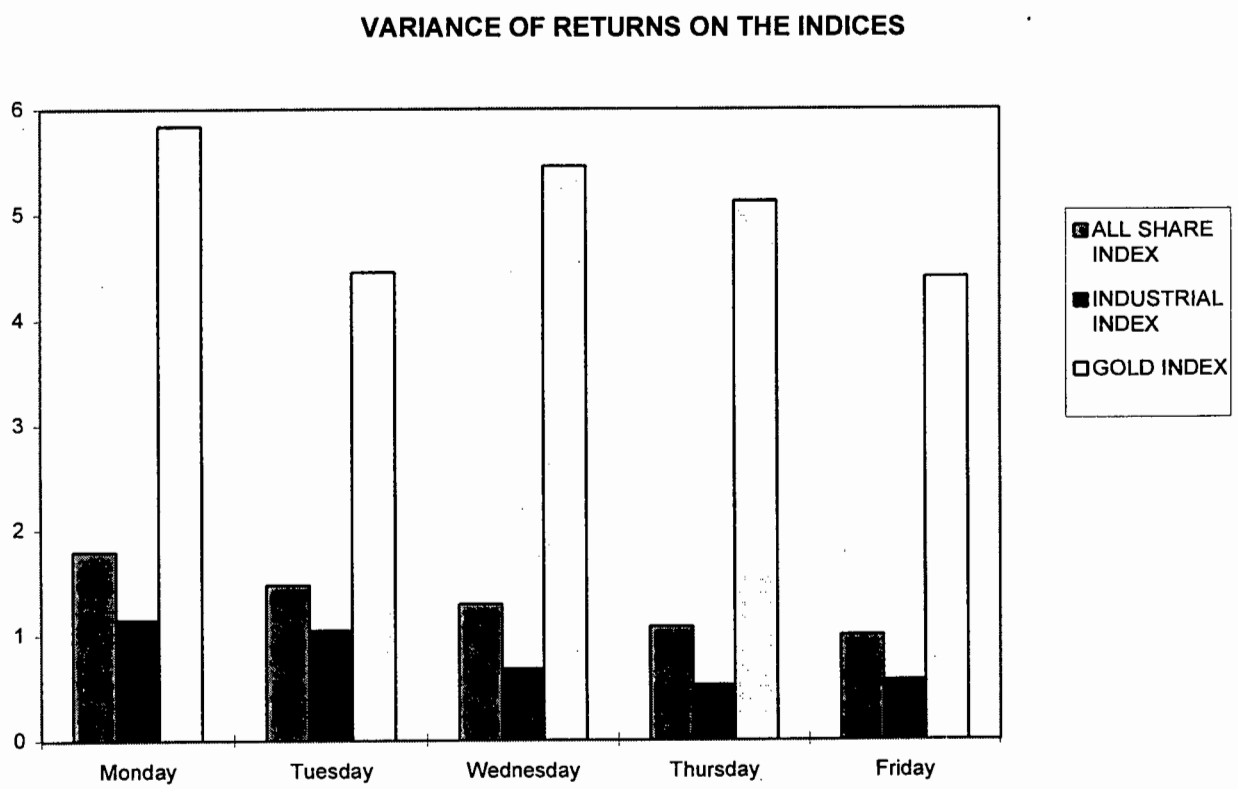
The following table gives an indication of the risk pertaining to each day of the week.

Table I
Variance of Returns across the Weekdays

DAY	ALL SHARE	INDUSTRIAL	GOLD
Monday	1,791265	1,145883	5,838672
Tuesday	1,472713	1,042541	4,454806
Wednesday	1,289123	0,676423	5,457507
Thursday	1,075835	0,522344	5,124855
Friday	0,994430	0,565853	4,404606
AVERAGE	1,328717	0,796240	5,061178

The first point that is very evident from Table I is the high volatility of the Gold Index in comparison to the All Share and Industrial Indices. This is yet another manner in which the Gold Index differs from the All Share and Industrial Indices, and can be seen very clearly in Graph 2.

GRAPH 2



What is of interest is the manner in which the variability in returns decreases from Monday to Friday. The only exception to

this rule is the variability of the Gold Index on Tuesday, which appears to be the second lowest variance of the week. It will be remembered that Tuesday is also the lowest return for the Gold Index - thus the negative return may be in response to the lower level of risk on Tuesdays. An additional point to note is that the returns for the Industrial and All Share Index are the lowest on Mondays - in fact Monday yields negative returns. Yet, these low returns do not appear to be offset by lower levels of volatility. Quite the contrary - the lower returns appear to be associated with higher levels of volatility/risk.

What is also of interest is the difference in volatility between the Industrial and Gold Index. The Gold Index is on average 6,4 times more volatile than the Industrial Index, while the returns on the Industrial Index are on average 1,9 times higher than the Gold Index! This is quite phenomenal.

It appears that the pattern of volatility of returns has changed from the time at which Bhana (1985) performed his tests. Bhana noted that Thursdays exhibited the highest volatility followed by Monday, Wednesday, Tuesday and Friday. The most notable occurrence has been the decrease in the volatility of Thursday's return.

Results regarding the variability in returns between the indices can be summarised as follows:

- The Gold Index has a higher volatility than the Industrial Index.
- Variability in returns decreases from Monday to Friday, except for the Gold Index where Tuesday's variance is the second lowest of the week. (Almost equal to the low Friday variance.)
- It appears that the excess returns on Wednesday are not a reward for bearing extra risk. It appears that an extra component of return is added to a regular trading day. This observation corresponds to Ariel's (1990) results where he documented a pre-holiday high. "Despite the much higher return, the pre-holiday variance of return is no larger than the return variance for all other days; means and variances do not increase proportionately."

4.5 Risk-adjusted returns

To this point returns and variance have been considered in isolation. In order to combine these two aspects into one measure, risk-adjusted returns need to be considered. This can be achieved by dividing daily returns by the standard deviations[4] of these daily returns. (Refer to equation {1a} in Chapter

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[4]Standard deviation is the square root of the variance. As was mentioned in chapter three, the exercise of dividing return by the standard deviation adjusts all returns to have a common variance of one. In this manner returns are comparable, since they all have a common risk - ie a variance of one.

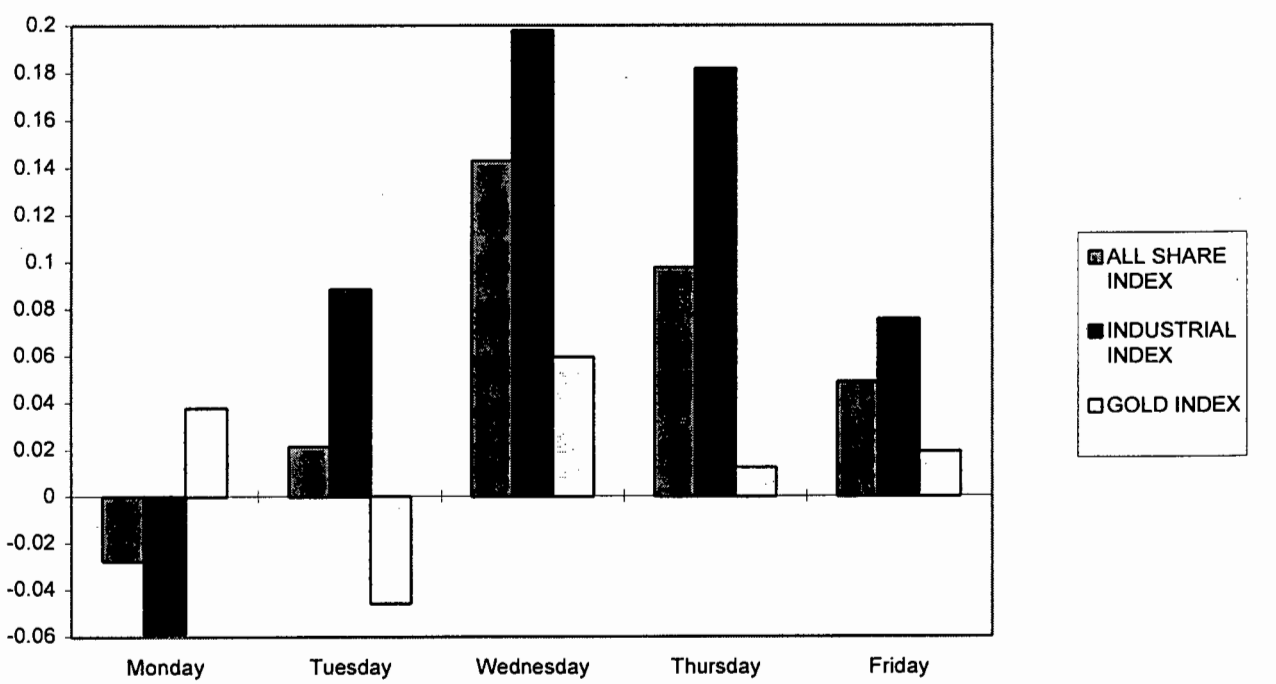
Three.) In this manner daily returns are made more comparable, since returns and variance appear to show a weekday effect, and one should never consider returns without considering the associated risk. The following results were obtained for the risk-adjusted returns:

Table J
Risk-adjusted Returns

DAY	ALL SHARE	INDUSTRIAL	GOLD
Monday	-0,02769	-0,05908	0,03768
Tuesday	0,02140	0,08834	-0,04585
Wednesday	0,1430	0,1979	0,05929
Thursday	0,09769	0,18185	0,01228
Friday	0,0486	0,07535	0,01887
AVERAGE	0,05287	0,08586	0,01776

GRAPH 3

RISK-ADJUSTED RETURNS ON THE INDICES



When Graph 3 is compared to Graph 1, it is noted that the pattern

of returns across the days of the week does not alter. The only observation that may be made is that the difference between returns on the different indices is more pronounced. This is particularly evident when Wednesday returns are considered. In Graph 1 it is noted that the returns for the different indices are roughly comparable. However, in Graph 3 the risk-adjusted returns are very different. It is clear that on Wednesdays the Industrial Index has the highest risk-adjusted return and the Gold Index has the lowest risk-adjusted return. Assuming a risk averse investor, one would expect more people to invest in the Industrial Index. However, the premium on options on the Gold Index will be higher than premiums on the Industrial Index, due to the higher volatility of the Gold Index.

Thus adjusting for risk has not altered the pattern of returns across the week, and has not had a significant impact on the Weekend Effect.

4.6 Statistical significance of returns

Monday is the only day to exhibit a negative return - apart from the Gold Index, where the negative return shifts to Tuesday. However, this pattern may not be statistically significant. In order to evaluate the statistical significance of differences in returns across days of the week, it is necessary to compute the t-statistics for the indices. In addition Bhana's (1985) results (which were based on the All Share Index only) are reproduced in Table K for comparative purposes.

Table K
T-Statistics for the indices[5]

DAY	ALL SHARE	BHANA'S	INDUSTRIAL	GOLD
Monday	-0,5355	-2,0151	-1,1425	0,7287
Tuesday	0,4215	0,1106	1,7401	-0,90327
Wednesday	2,8201	1,4230	3,9032	1,1779
Thursday	1,9119	0,8355	3,5590	0,2403
Friday	0,9412	0,5831	1,4591	0,3655

Based on his results in Table J, Bhana concluded that Monday's exhibited significantly negative returns at the 2,5% confidence level. However, there was no evidence of a significantly positive Friday effect. It was noted that Wednesday's showed a significantly positive return at the 10% level.

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[5] The t-statistics have been calculated as follows:

$$t\text{-}stat = \bar{x} - U / s(\bar{x}) \text{ where, } s(\bar{x}) = s/\sqrt{n}$$

and s is the sample standard deviation and $\bar{x}$ is the sample mean.

What is of interest is the manner in which Bhana calculates his t-statistic. Based on his data, the t-statistics were recalculated, (using on the formulae in footnote 5) and the following values were arrived at for Monday to Friday: -1,6219 1,4872 3,6307 2,2822 2,5332.

Based on the recalculated t-statistics, the following conclusions can be drawn. Firstly the negative Monday return can only be confirmed at the 5,5% significance level. In addition, the high t-statistic values for Wednesday, Thursday and Friday mean that these day's returns are significantly positive at the 0,1%, 2,5% and 10% levels respectively - Basically, returns are significantly positive on Wednesdays and Thursdays. Friday's returns are only significantly positive at the 10% level.

Closer scrutiny of Bhana's results indicate that his returns are far greater than this studies' returns for all days of the week. From this comparison, it appears as if returns on the indices have dropped fairly significantly from the period that Bhana studied to this study period.

The author contacted Bhana due to the discrepancy between his t-statistic values and the t-statistic values that this study calculates based on his data. He wrote back and indicated that he had "checked the t-statistic values that you provided and hereby confirm that your calculations are correct. The t-statistic values appearing in...my paper are not correct. Please use the t-statistics as calculated by yourself instead of those reported in my paper." As an additional test, this study determined if Bhana had perhaps calculated his t-statistic as being significantly different from some value other than zero. This calculation did not shed any additional light on the problem. Thus the conclusions drawn by Bhana appear to have been based on the incorrect t-statistics. This implies that for his study period there was no significantly negative Monday effect. In addition, it would appear as if there was a significantly positive Wednesday and Thursday return on the All Share Index.

The t-statistics (for this studies data period) shown in Table K indicate that returns on the All Share Index are significantly positive on Wednesdays and Thursdays and possibly Fridays - returns are only significantly different from zero at the 20% confidence level on Friday. (This is not considered to be a very significant level). The confidence level increases to 5% on Thursday, and 1% on Wednesday. Monday's return can only be said to be significantly negative at the 30% confidence level. These results are at odds with most international findings and Bhana's original conclusions. When Bhana's t-statistics are recalculated, his results and this studies' results are very similar. The only changes from Bhana's study are that the significance of the negative Monday and positive Friday return have decreased.

Based on this study period, it would appear as if the JSE shows significantly positive returns on Wednesdays and Thursdays on the All Share Index. The Industrial Index results show that Monday's returns are negative at the 15% confidence level. Tuesday,

Wednesday and Thursday's returns are all significantly positive above the 5% confidence level. The amazing observation is that the Wednesday and Thursday's returns are positive at the 0,1% confidence level. The t-statistics on the Gold Index indicate that the daily returns are not significantly different from zero on any particular day. Tuesday's returns can be said to be negative at the 20% confidence level, whereas Wednesday's returns can be said to be positive at the 15% confidence level. These confidence levels are not sufficiently precise to conclude that returns on the Gold Index are significantly different on any one of the weekdays.

What emerges from these statistics is that the JSE does not appear to trace most international markets with the negative Monday return and the positive Friday return -ie the Weekend Effect. The JSE shows significantly positive returns on Wednesday's, and this may, ironically, be some form of a Midweek Effect.

However, previous exercises have ignored public holidays. This assumes the trading time hypothesis to be correct - i.e. that returns are only generated during trading time. Holidays were eliminated from the data set in order to investigate what impact they have on the study of day of the week effects. That is to say the exercise was reperformed, except that the return for the day after the public holiday was eliminated from the data set. The return for the day after the holiday had previously been calculated by comparing it to the day before the public holiday. This implies an investment of at least two calendar days.

The same tests were performed on the modified data, but the results were not found to be significantly different. The t-statistics for the modified data set are presented below.

Table L
T-statistics for the indices adjusting for public holidays

DAY	ALL SHARE	INDUSTRIAL	GOLD
Monday	-0,7123	-1,3850	0,6657
Tuesday	0,6218	1,9532	-0,7368
Wednesday	2,9660	3,9990	1,3264
Thursday	2,1187	3,7017	0,4067
Friday	1,0544	1,3906	0,5539

These results clearly illustrate that the pattern of a significantly positive Wednesday and Thursday returns do not disappear when public holidays are eliminated from the data. For the sake of completeness, the other results from the study of the modified data are included in Appendix B. They have not been included in the body of the study, since they do not show any significant difference from the previous results.

Results of the t-statistic tests can be summarised as follows:

- There does not appear to be a significantly negative Monday return, or a positive Friday return. Thus there does not appear to be a Weekend Effect on the JSE. This is at odds with most of the international findings discussed in Chapter Two.
- There appears to be a significantly positive return for Wednesdays and Thursdays. This will be referred to as the Midweek Effect.
- The Gold Index once again exhibits atypical behaviour by not displaying any returns as being significantly different from zero. (This is measured against a 95% confidence level.)

4.7 Tests on Calendar and Trading time hypotheses

The negative Monday return implies that neither the trading time or calendar time hypotheses offer an adequate explanation of the manner in which returns are generated on the JSE. It will be remembered that if returns are generated in calendar time, then Monday's return would be three times as great as the return on any other weekday, since Monday represents a three calendar day investment - Saturday, Sunday and Monday. If returns are generated in trading time, then Monday's return will be equal to the returns on all of the other days of the week. French (1980) used regression techniques to formally evaluate these two hypotheses. Regression analysis is also used in this study. Equations {2} and {3} from Chapter Three are used, which are the same equations used by French.

The regression for the trading time hypothesis (equation {2}) was performed on Lotus. The results for the three indices are presented on the following pages.

Regression output for indices based on the Trading Time Hypothesis

Regression Output: ALL SHARE INDEX
No. of observations 1909
Degrees of Freedom 1904

	Monday (Constant)	Tuesday	Wednesday	Thursday	Friday
Parameter Estimate	-0.03706	0.063027	0.199407	0.13839	0.085528
Stndized Estimate	0.0000	0.0220	0.0679	0.0481	0.0295
Standard Error	0.05958	0.083495	0.083442	0.083762	0.084202
t-stat (b=0)	-0.62	0.754862	2.389757	1.652182	1.015742
Prob. Level	0.5339	0.4503	0.0169	0.0985	0.3098
F-stat	0.3844	0.569817	5.710938	2.729705	1.031732
Seq. R-Sqr		0.0002	0.0020	0.0029	0.0034
Simple R-Sqr		0.0002	0.0020	0.0003	0.0000

Analysis of variance report:

Source	df	Sums of Squares (Sequential)	Mean Square	F-ratio	Prob. Level
Constant	1	7.091356	7.091356		
Model	4	8.749856	2.187464	1.65	0.160
Error	1904	2527.772	1.327611		
Total	1908	2536.521	1.329414		

Root Mean Square Error	1.15222
Mean of Dependent Variable	0.0009483
Coefficient of Variation	18.90487
R Squared	0.0034
Adjusted R Squared	0.0014

Regression output for indices based on the Trading Time Hypothesis

Regression Output: INDUSTRIAL INDEX
No. of observations 1909
Degrees of Freedom 1904

	Monday (Constant)	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Parameter Estimate	-0.06324	0.153439	0.226007	0.194674	0.11992
Stndized Estimate	0.0000	0.0692	0.1020	0.0874	0.0534
Standard Error	0.04603	0.0645	0.064459	0.064706	0.065046
t-stat (b=0)	-1.37	2.378914	3.50622	3.008592	1.843619
Prob. Level	0.1694	0.0174	0.0005	0.0026	0.0652
F-stat	1.8769	5.659232	12.2935	9.051626	3.39893
Seq. R-Sqr		0.0001	0.0028	0.0058	0.0076
Simple R-Sqr		0.0001	0.0024	0.0009	0.0001

Analysis of variance report:

Source	df	Sums of Squares (Sequential)	Mean Square	F-ratio	Prob. Level
Constant	1	11.2049	11.2049		
Model	4	11.57405	2.893512	3.65	0.006
Error	1904	1508.448	0.7922522		
Total	1908	1520.022	0.7966573		

Root Mean Square Error 0.8900855
Mean of Dependent Variable 0.0766128
Coefficient of Variation 11.61798

R Squared 0.0076
Adjusted R Squared 0.0055

Regression output for indices based on the Trading Time Hypothesis

Regression Output: GOLD INDEX
No. of observations 1909
Degrees of Freedom 1904

	Monday (Constant)	Tuesday	Wednesday	Thursday	Friday
Parameter Estimate	0.91043	-0.18783	0.048472	-0.06325	-0.05144
Stndized Estimate	0.0000	-0.0336	0.0087	-0.0113	-0.0091
Standard Error	0.116409	0.163135	0.163032	0.163657	0.164517
t-stat (b=0)	0.78	-1.15138	0.297317	-0.38648	-0.31265
Prob. Level	0.4342	0.2429	0.7662	0.6991	0.7545
F-stat	0.6084	1.325675	0.088310	0.149366	0.097750
Seq. R-Sqr		0.0009	0.0012	0.0012	0.0013
Simple R-Sqr		0.0009	0.0005	0.0000	0.0000

Analysis of variance report:

Source	df	Sums of Squares (Sequential)	Mean Square	F-ratio	Prob. Level
Constant	1	3.046821	3.046821		
Model	4	12.14376	3.03594	0.60	0.663
Error	1904	9649.647	5.068091		
Total	1908	9661.79	5.063831		

Root Mean Square Error	2.251242
Mean of Dependent Variable	0.03995034
Coefficient of Variation	56.35101
R Squared	0.0013
Adjusted R Squared	0.0000

The results of the regression analysis based on the trading time hypothesis, leads to the following conclusions:

All Share Index

An analysis of the results for the All Share Index once again shows the negative Monday return, while the returns for the rest of the weekdays are positive (See the Parameter estimate row). However, when one looks at the t-statistics and probability levels for each weekday, it will be noted that for all days (EXCEPT Wednesday) the null hypothesis can be accepted (ie b=0). This implies that the difference between Mondays return and the other weekdays is NOT significantly different at the 5% level. However, it will be noted that for Wednesday the hypothesis is rejected at the 2% significance level. This indicates that there is a high Midweek Effect which has already been referred to in this chapter[6].

The F-stat from the analysis of variance report shows that the trading time hypothesis can be accepted, since daily returns at a joint significance level are not different from each other. Thus there is evidence to support the trading time hypothesis.

Industrial Index

Regression analysis indicates a stronger negative Monday effect, with the other weekdays exhibiting positive returns. The t-statistics and the associated probability levels indicate that the null hypothesis (returns are not significantly different from Monday) can be rejected at the 2% significance level.[7]This clearly indicates a Midweek Effect with Wednesday's return differing from Monday's return at the 0.5% level!

The analysis of variance report shows an F-ratio of 3.65. This indicates the trading time hypothesis for the Industrial Index is rejected at the 2% significance level.It would appear that returns on the Industrial Index are not generated in trading time.

Gold Index

The negative Tuesday return is shown from the regression analysis. It will be noted that t-stat values across all of the weekdays lead to the conclusion that the trading time hypothesis can be accepted. (Note that all of the probability levels are well in excess of the 5% level of significance.)

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[6]It should be noted that the trading time hypothesis is rejected at the 10% level for Thursdays as well. However, this result is only added as a footnote, since 10% significance allows for a relatively large margin of error.

[7]The difference between Thursday's and Monday's return can also be rejected at the 5% significance level.

It comes as no surprise that the F-ratio for the model as a whole leads to the acceptance of the trading time hypothesis. It appears that returns on the Gold Index are generated in trading time.

Regression output for indices based on the Calendar Time Hypothesis

Regression Output: ALL SHARE INDEX

	Monday (Constant)	Tuesday	Wednesday	Thursday	Friday
Parameter Estimate	-0.0124	0.02597	0.1623458	0.101329	0.04847
Stndized Estimate	-0.0142	0.0101	0.0635	0.0393	0.0186
Standard Error	0.01986	0.05850	0.05842	0.05888	0.05950
t-stat (b=0)	-0.62	0.44	2.78	1.72	0.81
Prob. Level	0.5339	0.6571	0.0055	0.0852	0.4153
F-stat	0.3844	0.1936	7.7284	2.9584	0.6561
Seq. R-Sqr	0.0002	0.0003	0.0043	0.0059	0.0062
Simple R-Sqr	0.0002	0.0001	0.0040	0.0015	0.0003

Analysis of variance report:

Source	df	Sums of Squares (Sequential)	Mean Square	F-ratio	Prob. Level
Constant	0	0	0		
Model	5	15.84121	3.168242	2.39	0.036
Error	1904	2527.772	1.327611		
Total	1909	2543.613	1.332432		

Root Mean Square Error	1.15222
Mean of Dependent Variable	0.06094831
Coefficient of Variation	18.90487
R Squared	0.0062
Adjusted R Squared	0.0041

Regression output for indices based on the Calendar Time Hypothesis

Regression Output: INDUSTRIAL INDEX

	Monday (Constant)	Tuesday	Wednesday	Thursday	Friday
Parameter Estimate	-0.0211	0.09020	0.162766	0.134326	0.05668
Stndized Estimate	-0.0313	0.0454	0.0820	0.0657	0.0280
Standard Error	0.01534	0.04519	0.04513	0.04548	0.04596
t-stat (b=0)	-1.37	2.00	3.61	2.89	1.23
Prob. Level	0.1694	0.0459	0.0003	0.0039	0.2175
F-stat	1.8769	4.0000	13.0321	8.3521	1.5129
Seq. R-Sqr	0.0010	0.0030	0.0098	0.0141	0.0149
Simple R-Sqr	0.0010	0.0021	0.0067	0.0043	0.0008

Analysis of variance report:

Source	df	Sums of Squares (Sequential)	Mean Square	F-ratio	Prob. Level
Constant	0	0	0		
Model	5	22.77895	4.55579	5.75	0.000
Error	1904	1508.448	0.7922522		
Total	1909	1531.227	0.8021095		

Root Mean Square Error	0.8900855
Mean of Dependent Variable	0.07661276
Coefficient of Variation	11.61798
R Squared	0.0149
Adjusted R Squared	0.0128

Regression output for indices based on the Calendar Time Hypothesis

Regression Output: GOLD INDEX

	Monday (Constant)	Tuesday	Wednesday	Thursday	Friday
Parameter Estimate	0.03035	-0.0968	0.1395155	0.02779	0.03961
Stndized Estimate	0.0179	-0.0194	0.0280	0.0055	0.0078
Standard Error	0.03880	0.114289	0.11414	0.11503	0.11625
t-stat (b=0)	0.78	-0.85	1.22	0.24	0.34
Prob. Level	0.4342	0.3971	0.2216	0.8091	0.7333
F-stat	0.6084	0.7225	1.4884	0.0576	0.1156
Seq. R-Sqr	0.0003	0.0007	0.0015	0.0015	0.0016
Simple R-Sqr	0.0003	0.0004	0.0008	0.0000	0.0001

Analysis of variance report:

Source	df	Sums of Squares (Sequential)	Mean Square	F-ratio	Prob. Level
Constant	0	0	0		
Model	5	15.19058	3.038116	0.60	0.700
Error	1904	9649.647	5.068091		
Total	1909	9664.837	5.062775		

Root Mean Square Error	2.251242
Mean of Dependent Variable	0.03995034
Coefficient of Variation	56.35101
R Squared	0.0016
Adjusted R Squared	0.0000

The results of the regression analysis based on the calendar time hypothesis, leads to the following conclusions:

All Share Index

It will be noted that returns for Monday are approximately one-third of the trading time hypothesis returns. This is to be expected, since the calendar time hypothesis postulates that Monday's return should be three times any other weekday's return. T-statistics and probability levels indicate that the calendar time hypothesis is accepted on all weekdays EXCEPT Wednesday. In the case of Wednesday the calendar time hypothesis is rejected at the 2% significance level.[8]

The analysis of variance report indicates that the calendar time hypothesis should be rejected at the 5% significance level.

Industrial Index

The t-statistics and associated probability levels indicate that the calendar time hypothesis should be rejected at the 5% level for Tuesdays, Wednesdays and Thursdays.[9]

The F-ratio for the calendar time model as a whole clearly shows that the calendar time hypothesis does not provide an adequate explanation as to how returns are generated on the Industrial Index.

Gold Index

T-stat results from the regression run on the Gold Index indicate that the calendar time hypothesis cannot be rejected for any of the weekdays. In addition, the F-stat indicates that the calendar time hypothesis for the model as a whole cannot be rejected.

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[8]The calendar time hypothesis for Thursdays is also rejected at the 10% significance level.

[9]The calendar time hypothesis is rejected for Wednesdays on the industrial index at the 1% level of significance.

Table M
Summary of results of regression analysis to test the Trading and Calendar time hypotheses

	TRADING TIME			CALENDER TIME		
	ALL	**IND**	**GOLD**	**ALL**	**IND**	**GOLD**
Tuesday	A	R	A	A	R	A
Wednesday	R	R	A	R	R	A
Thursday	A	R	A	A	R	A
Friday	A	A	A	A	A	A
OVERALL	A	R	A	R	R	A

Table M summarises the results of the regression analysis performed on the three indices for the calendar time and trading time hypothesis. "R" indicates that the hypothesis should be rejected, while "A" indicates that the hypothesis should be accepted. It should be noted that the daily results (Tuesday, Wednesday, Thursday and Friday) refer to the t-statistics and probability levels. These results reflect whether there is a significant difference between the day in questions return and Monday's return. The OVERALL row in Table M refers to whether the trading or calendar time hypothesis should be accepted or rejected for the index as a whole. (ie Does the trading or calendar time hypothesis offer an adequate explanation of the manner in which returns are generated on the All Share Index, Industrial Index or Gold Index?)

The daily return results (ie rows 1-4, Tuesday, Wednesday, Thursday and Friday) indicate that, for both the calendar and trading time hypotheses, Friday's returns are not significantly different from Monday's returns. It appears as if there is no evidence of a Weekend Effect on the JSE. While there is evidence of a negative Monday return, there is no evidence of an abnormally high Friday return. These results show that share prices drop from the Friday close to the Monday close, but that prices do not to increase significantly from the Thursday close to the Friday close.

The OVERALL row indicates whether the model should be accepted or rejected as a whole. The trading and calendar time hypotheses do not appear to provide an adequate explanation for the return generating process on the **Industrial Index**. This corresponds with international studies rejecting the trading and calendar time

hypotheses[10]. The calendar time hypothesis is rejected for the All Share Index, while the trading time hypothesis is accepted. Thus there appears to be limited evidence to support the trading time hypothesis on the All Share Index[11]. These results indicate that weekends are effectively ignored in the return generating process for share markets - no returns are generated over weekends. However, there can be no doubt that interest is earned over weekends and public holidays for any interest bearing instrument. Thus "a calendar time view is relevant for interest bearing securities" (ie Bonds, or fixed deposits) (Lakonishok & Levi, 1982). The above evidence suggests that returns on the All Share Index are generated in trading time, while in theory returns on any interest bearing security are generated in calendar time.

Results on the Gold Index are somewhat perplexing since they indicate that both the trading and calendar time hypotheses are acceptable. The reasons for this can only be speculated upon, and could form the basis for future research. One could postulate that a large proportion of gold shares making up the Gold Index are traded on international markets, and thus their returns are generated twenty four hours per day. This would imply that for shares traded internationally the returns are generated in calendar time, while shares not listed on international markets are only traded in trading time. Thus the Gold Index is a hybrid of shares traded both internationally (calender time) and locally (trading time). For this reason it may be that both the trading time and calendar time hypotheses are accepted for the Gold Index.

4.8 Returns adjusted for settlement effects

It will be remembered from Chapter Three that the settlement period for shares purchased on the JSE will vary according to the day on which the shares are purchased. There can be little doubt that in theory the settlement effect should be adjusted for, since interest is earned in calendar time (Lakonishok & Levi, 1985). The settlement period prior to 30 May 1991 was fourteen business days. This would imply (refer to Table C in Chapter Three) that shares purchased on Mondays and Tuesdays would result in an eighteen calendar day settlement period. This would consist of fourteen business days and two weekends. However, shares purchased on Wednesdays, Thursdays and Fridays would result in a twenty calendar day settlement period. This was due to the fact

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[10]See French (1980) who studied the S & P composite portfolio in U.S., Theobald & Price (1984) who studied the Financial Times(FT) Ordinary and FT All Share indices in U.K., Jaffe & Westerfield (1985) who studied the Nikkei Dow {Japan} Toronto Stock Exchange Index {Canada} and the Statex Actuaries Index {Australia}.

[11]This supports the findings of Davidson & Meyer (1993) on the All Share Index. Their study only came to the authors attention after the performance of the regression analysis.

that an extra weekend fell between purchase and settlement. Thus the twenty day settlement period consisted of fourteen business days and three weekends (ie six weekend days). Clearly any Wednesday, Thursday or Friday transaction would result in the purchaser earning an additional two days of interest on his/her money before having to settle. The converse is that the seller would have an opportunity cost of selling on the last three days of the week. This opportunity cost would be equal to two days of interest. In a weak-form efficient market one would expect share prices to compensate for this uneven settlement period. The share prices should adjust upwards by two days of risk free interest on Wednesdays, Thursdays and Fridays. This would cause an abnormally large return on Wednesday, since Wednesday's closing value is compared to Tuesday's closing index value. In addition, it would cause a low or negative Monday return since Monday's return is calculated by comparing it to the closing value of the index on Friday. These comments appear to explain the high Midweek and negative Monday returns that are documented in this paper. The potential bias that settlement effects may have on return patterns needs to be adjusted for. This could be achieved by subtracting two days of interest from the Wednesday, Thursday and Friday closing index values. However, a more efficient method is to adjust Wednesday returns downwards by two days of interest and adjust Monday returns upwards by two days of interest. This is done since returns are calculated according to equation {1}, and thus the index value is always compared to the preceding day. If the preceding day already has the interest factor grossed into it, then there is no need to adjust the return for that day.

It will be remembered that the settlement period changed from fourteen business days to seven business days on 30 May 1991. This implies that the settlement effect tends to cause a high Friday and low or negative Monday return after the 30 May 1991 - refer to Table D in Chapter Three. After 30 May 1991, Friday's returns need to be adjusted downwards by two days of interest, and Monday returns need to be adjusted upwards by two days of interest.

The required adjustment is made by obtaining the Bankers Acceptance Rate (BA Rate) on a daily basis for the period under study. The fact that this study uses a daily interest rate is an improvement on previous studies (Lakonishok & Levi, 1985) which used an average interest rate for the study period. South Africa has witnessed extremely volatile interest rates. In the seven and a half year study period the BA rate reached a high of 18,3% and a low of 8,2%. It is less accurate to perform the adjustment using an average rate with such volatile interest rates. In addition, by using the daily interest rate, we are not assuming that interest rates are even across all weekdays. (It may be that interest rates also exhibit day of the week patterns. To assume, as other studies have done, that interest rates are on average even across all weekdays is dangerous.) The adjustment for settlement delays yields the results in Table N.

Table N
Average returns adjusted for settlement effects

DAY	ALL SHARE	INDUSTRIAL	GOLD
Monday	0,038806	0,012626	0,166910
Tuesday	0,025965	0,090197	-0,09678
Wednesday	0,098099	0,098520	0,075269
Thursday	0,101329	0,131432	0,027792
Friday	0,024933	0,033146	0,016074

The adjustment performed in Table N makes the weekdays more comparable, since it removes the potential bias caused by an uneven settlement period. Wednesday and Monday returns have been adjusted for prior to 30 May 1991. Friday and Monday returns have been adjusted for after 30 May 1991. It is noted that the negative Monday return on the All Share Index, and Industrial Index has disappeared. This because Monday returns have been adjusted upwards by two days of interest, due to delays between transaction date and settlement date. In addition the magnitude of the positive Wednesday return has declined when the interest effect is removed. It appears as if the negative Monday and positive Wednesday, that have been documented in this study, are a function of settlement delays.

It is noted that all returns on the All Share and Industrial Indices are positive. It appears that Thursdays now exhibit the highest return of the week. After the adjustment for settlement delays, the Gold Index still displays a negative Tuesday return. What is of interest is that Monday now displays the largest return of the week. Calculation of the t-statistics based on the returns adjusted for settlement delays is presented in Table O.

Table O
T-statistics based on returns adjusted for settlement delays

DAY	ALL SHARE	INDUSTRIAL	GOLD
Monday	0,5607	0,2281	1,3359
Tuesday	0,4215	1,7401	-0,90327
Wednesday	0,70408	2,3626	0,870684
Thursday	1,9119	3,5590	0,2403
Friday	0,3850	0,6313	0,1471

Table O confirms the observation that the Gold Index appears to show no clear pattern across the week. T-statistics indicate that, at the 5% confidence level, non of the returns are significantly different from zero. Thus once returns are adjusted for settlement delays, the gold returns are not significantly

different from zero on any of the weekdays. These results support the trading time hypothesis. However, despite the downward adjustment to Wednesdays for settlement effects, the returns are still significantly positive at the 1% level on the Industrial Index. The Industrial Index still has a significantly positive Thursday return at the 0,5% level. This once again appears to indicate a Midweek Effect on the Industrial Index. There is no doubt that a portion of the abnormally high Wednesday return can be explained away by the bias caused by settlement delays. However, not all of the excessive return can be explained by the uneven settlement period. The All Share Index shows that only Thursdays returns are significantly positive at the 5% confidence level.

Returns adjusted for settlement delays have been divided into two time periods - the period prior to 30 May 1991, and the period after 30 May 1991. These two periods relate to the fourteen and seven business day settlement period. The results have been presented in Appendix C.

Settlement delays can be summarised as follows:

- There can be no doubt that uneven settlement periods should be adjusted for.
- After the adjustment for settlement delays, it is noted that the Gold Index does not exhibit any significant day of the week effect. The day of the week effect previously noted can probably be ascribed to settlement effects.
- After adjusting for settlement delays the Industrial Index still exhibits a strong Midweek Effect. This is witnessed by Wednesday returns being significantly positive at the 1% level, and Thursday returns being significantly positive at the 0,5% level. However, settlement delays do explain a large portion (approximately 60%[12]) of the Midweek Effect.
- The All Share Index shows no strong day of the week effect after the adjustment for settlement delays. (Thursday returns can be said to be positive at the 5% significance level. This is almost certainly due to the influence of the Industrial Index.)

4.9 Returns adjusted for dividend effects

Another factor which impacts on the pattern of daily returns is the LDR. The LDR is the day on which shares go ex-dividend. A transaction on LDR implies that the purchaser obtains the dividend, while the seller has no right to the declared dividend. A share that changes hands on the day after LDR trades ex-dividend. Thus the purchaser has no right to the dividend, while the seller has full legal title to the dividend, despite the fact that the investor has sold the share prior to actual payment

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[12]Lakonishok and Levi (1982) found that the settlement effect accounted for about 20% of the weekend effect. Board and Sutcliffe (1988) found that it accounted for about 40% of the negative monday return.

date.

It is not necessary to adjust for the impact of dividends, if LDR's show no distinct pattern across weekdays. However, if one day of the week is typically the day on which share's LDRs fall, then it implies that returns for the day after the LDR need to be adjusted for. This is because share prices will, in theory, drop by the amount of the dividend on the day after LDR. The "ex dividend effect will produce a negative return for the day the share goes ex dividend, proportional to the size of the lost dividend" (Board & Sutcliffe, 1988). The amount of the adjustment is equal to the dividend yield attributable to that particular index, since the dividend effect "is governed by the size of the dividend lost" (Board & Sutcliffe, 1988).

The LDR's for the All Share Index were obtained for the top forty shares on the All Share Index. These can be found in Appendix D. It will be noted from Appendix A that the top forty shares account for more than 75% of the All Share Index. Based on the results of Appendix D, it can safely be assumed that the LDR is not spread evenly across all weekdays. In fact there is very clear evidence that the LDR for shares on the JSE falls on a Friday. These results correspond to Levett's (1991) observation that "nearly all companies LDR dates fall on a Friday." This observation comes as no real surprise, since "in common with many stock exchanges, most shares ... have last days to register on the last trading day of the week" (Davidson & Meyer, 1993). This is confirmed by Board and Sutcliffe's study of the Financial Times All Share Index, where the dividend adjustment is made to Monday's returns. This is due to the fact that the LDR on the London markets also falls on a Friday.

The fact that the LDR shows such a clear weekday effect, implies that returns must be adjusted for. Since it can be concluded that the LDR for at least 75% of the All Share Index falls on a Friday, Monday's return must be increased by the dividend yield attributable to the All Share Index. This is because shares with an LDR on Friday trade ex-dividend on Monday. Thus the share prices drop on Monday by the amount of the dividend. (In theory the price should drop by the present value of the dividend. For the purposes of this study the difference between present value and actual dividend value is considered to be negligible.) This means that the closing value of the index on Monday is lower due to the LDR falling on Friday. To adjust for this, Monday's return must be increase by the value of the dividend yield on the index. This methodology is also used by Davidson and Meyer (1993) where "the additional gain from the dividends were then added to the return for the first trading day of the following week." The process of obtaining the dividend yield on the indices is common to that used by Board and Sutcliffe. The monthly dividend yield on the indices is obtained, and from this the average dividend yield for each of the years in the study period is calculated. The results of this exercise are presented in Appendix E. These results are used to compute the average dividend yield for the entire period. The average dividend yield is used to adjust Monday's returns for ex dividend effects. Daily returns, adjusted

for dividends, are presented in Table P.

Table P
Average returns adjusted for dividend effects

DAY	OBSERVATIONS	ALL SHARE	INDUSTRIAL	GOLD
Monday	374	-0,02665	-0,05427	0,10441
Tuesday	388	0,025965	0,090197	-0,09678
Wednesday	389	0,162345	0,162766	0,138515
Thursday	383	0,101329	0,131432	0,027792
Friday	375	0,048466	0,056678	0,039607
TOTAL	1909	0,060948	0,076612	0,039950

Comparison of Table P to Table G indicates that Monday returns have been adjusted upwards for the effect of the ex dividend. It can be seen that the negative Monday return on the All Share and Gold Index has not disappeared, but has been reduce by a significant amount. In fact, the dividend effect explains 28% and 14% of the negative Monday return on the All Share and Industrial Indices respectively.

4.10 Simultaneous adjustment for interest and dividend effects

In practice all of the potential influences on the closing index values, and therefore returns, work in combination. Thus all of these factors need to be adjusted for simultaneously. This exercise performs such a test by adjusting for interest effects and dividend effects concurrently. The results of such a test are presented in Table Q.

Table Q
Average returns adjusted for settlement and dividend effects

DAY	ALL SHARE	INDUSTRIAL	GOLD
Monday	0,049217	0,021694	0,180280
Tuesday	0,025965	0,090197	-0,09678
Wednesday	0,098099	0,098520	0,075269
Thursday	0,101329	0,131432	0,027792
Friday	0,024933	0,033146	0,016074

Table Q shows returns adjusted for settlement delays and ex-dividend effects. Monday returns have been increased due to the ex-dividend effects, while Wednesday returns have been adjusted downwards and Monday returns adjusted upwards for settlement delays. (After 30 May 1991, Friday returns and not Wednesday returns were adjusted downwards for the effects of settlement

delays.) These adjustments have no impact on the conclusions drawn under sections 4.8 and 4.9. This is because dividend and settlement effects only simultaneously impact on Monday returns. T-statistics calculated for Monday (0,7112; 0,3919; and 1,4429 for the All Share, Industrial and Gold Indices respectively) still do not make its return significantly different from zero. Thus it can be concluded that the negative Monday return on the JSE can be ascribed to settlement delays and ex-dividend effects.

4.11 Summary of Chapter Four

Chapter Four deals with the empirical results from the econometric tests described in Chapter Three. These tests were performed on the closing values of the All Share, Industrial, and Gold Indices. This is the first time that such a study has been performed on indices other than the All Share Index. This represents a significant improvement on previous studies, since it analyses day of the week effects on each of the indices separately. In addition, some of the international studies were carried out on industrial indices, and thus the results on the Industrial Index can be compared to these studies.

The first test showed that the number of positive returns exceeded the number of negative returns on all weekdays, EXCEPT Mondays, on the All Share and Industrial Indices. The Gold Index displayed the opposite pattern, with the number of negative returns exceeding the number of positive returns on all weekdays, EXCEPT Wednesdays. This was the first sign of a high Midweek Effect.

The second test calculated the average returns on each of the weekdays. What is interesting is that the results from test one on the All Share and Industrial Indices carried over to test two. That is to say that average returns were positive on all days, except Mondays. However, despite negative returns exceeding positive returns on the Gold Index, the average returns on all weekdays was positive, except Tuesdays. Thus there is evidence of a negative Monday return on the All Share and Industrial Indices, and a negative Tuesday return on the Gold Index.

Another interesting feature of the study is the high Wednesday return on all of the indices. This high Midweek Effect is not a compensation for additional risk, since the variance in returns decreases across the week from Monday to Friday. T-statistics indicated that there is no significant negative Monday, or positive Friday, and thus there is no Weekend Effect on the JSE. However, the t-statistics do indicate a Midweek Effect, as Wednesday's returns are significantly positive. (At the same time, it was discovered that the t-statistics used by Bhana (1985) had been incorrectly calculated. Thus the conclusions reached in his study cannot be relied upon. Once the recalculated t-statistics are used, his results confirm this studies findings.)

Regression analysis is used to test the calendar and trading time hypotheses. The results of this study indicate that the trading

time hypothesis provides an acceptable explanation to the manner in which returns are generated on the All Share Index. However, both hypotheses are rejected for the Industrial Index. Results on the Gold Index are puzzling, since they indicate that both the trading and calendar time hypotheses provide acceptable postulates as to how returns are calculated on this index.

The chapter then focuses on potential biases caused in returns due to, amongst other things, settlement delays and ex-dividend effects. It is noted that the settlement effect contributes to the negative Monday return and positive Wednesday return. In addition, calculations show that ex dividend effects contribute to the negative Monday return. Once these factors are adjusted for, the negative Monday return vanishes, and the abnormally high Midweek Effect diminishes.

Consequently it can be concluded that the negative Monday return is almost certainly due to rational investors factoring settlement and ex-dividend effects into Monday share prices. Once these have been adjusted for the negative Monday return disappears. The large portion of the high Midweek Effect can almost certainly be ascribed to the rational investors factoring settlement delays into Wednesday share prices. However, settlement delays do not fully explain this Midweek Effect, and it remains an unexplained anomaly on the JSE.

CHAPTER FIVE

CONCLUSIONS

5.1 Introduction

This chapter concludes on the study of day of the week share return patterns on the JSE. The contributions and improvements upon previous research is discussed. The significant results from this study are summarised, and conclusions are drawn. Unfortunately not all aspects in this field of study can be adequately covered due to the shortage of data availability and limitations on the scope. Thus, suggestions as to where future research can improve and enhance on this study are also discussed.

5.2 Contributions of this study

The purpose of this study is to determine if the JSE equity indices exhibit similar empirical anomalies to those found on other stock exchanges. These anomalies relate to the distribution of share returns across weekdays. To date no viable explanation to these anomalies has been documented. This paper is a follow-up to the study conducted by Bhana (1985) on the JSE. As such it fulfils Bhana's recommendation that follow-up studies should be conducted as more computer based information becomes available. However, apart from updating Bhana's results, it also improves and expands upon his research in several significant areas.

This study was conducted on the All Share Index, Industrial Index and Gold Index, while Bhana's study was limited to the All Share Index. Investigation of the sub-indices allows one to determine whether gold shares have a unique impact on day of the week share return patterns. In addition, Bhana's study did not investigate any possible explanations to the Weekend Effect. This paper analyses international literature on the subject, and utilises these studies to try and obtain an explanation to day if the week effects on the JSE.

A unique aspect of this study is that it includes the period over which the futures exchange was introduced to the South African markets. As such it is possible to establish whether the futures market has impacted on the pattern of intraweek share returns.

Most research on the JSE assumes that share returns are even across the weekdays. This study shows that this assumption does not correlate with the empirical evidence. Thus future research must take this studies' results into consideration. This study also improves upon international studies, as daily interest rates are used to adjust for settlement delays, whereas international studies use average interest rates. The use of daily interest rates is more accurate, as it adjusts for any potential day of

the week effects in interest rates.

5.3 Summary of findings

The All Share and Industrial Indices display negative Monday returns similar to U.K. and U.S. share markets. The Gold Index displays negative Tuesday returns[1], which have been documented in Japan and Australia by Jaffe and Westerfield (1985). Thus the pattern of Gold Index returns appear to be atypical in comparison to the All Share and Industrial Indices. What is, however, common between the indices is the high Wednesday return. The high Midweek Effect has not been documented in international research. This indicates that while the JSE has a negative Monday, it does not have a Weekend Effect. The negative Monday and high Wednesday returns correspond to Bhana's (1985) results on the All Share Index. This indicates that the pattern of returns on the JSE has not changed over the last decade.

The variance of returns decreases from Monday to Friday, except for Tuesday's Gold Index variance, which is the second lowest of the week. However, the pattern of returns does not alter, even after returns have been adjusted for risk. Based on t-statistics only Wednesday and Thursday returns on the All Share and Industrial Indices are significantly positive.

Regression analyses testing the trading and calendar time hypotheses indicate that the trading time model is acceptable for the return generating process on the All Share Index. However, both hypotheses do not appear to provide an adequate explanation of the return generating process on the Industrial Index.

This result corresponds with several international studies which reject both the calendar and trading time hypotheses. The results on the Gold Index are somewhat perplexing since they indicate that both hypotheses are acceptable. A few possible explanations for this are discussed in Chapter Four, but further investigation of these results could form the basis for future research.

During the study period the settlement period changed from fourteen to seven business days. In order to adjust for the effects of delayed settlement, two days of interest is deducted from Wednesday's return and added to Monday's return[2].

After adjustmenting for settlement delays, the results show that the negative Monday return has disappeared. Thus it appears as

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[1]It should be noted that the Gold Index had a negative Monday return prior to the introduction of SAFEX. It was only after the introduction of SAFEX that the negative Monday return shifted to Tuesday.

[2]After 30 May 1991, it was Friday's, and not Wednesday's returns, that were adjusted downwards by two days of interest. This was due to the settlement period changing from fourteen to seven business days.

if the negative Monday return is the result of uneven settlement delays. In addition it is found that the All Share and Gold Indices display no significant day of the week effect after adjusting for settlement delays.

Dividends may affect the pattern of intraweek returns, should the LDR systematically fall on any one particular weekday. This is due to the effects of shares trading ex-dividend on the day after LDR. This research shows that the LDR tends to systematically fall on a Friday. To adjust for the potential bias in the results, due to the effects of dividends, Monday returns are adjusted upwards by the average dividend yield on the respective index. Adjusted returns indicate that dividends explain 28% , 14% and 15% of the negative Monday return for the All Share Industrial and Gold Indices.

When settlement effects and dividend effects are adjusted for simultaneously, it is found that the All Share and Gold Indices display no significant day of the week effect. Settlement delays explain the Midweek Effect on the All Share Index, while a combination of the settlement effect and the dividend effect explain the negative Monday return. However, the Midweek Effect remains an unexplained anomaly on the Industrial Index.

5.4 Areas for Future Research

Due to a lack of data availability this study was unable to determine whether the negative Monday return accrues during trade on Monday or over the non-trading weekend. Only when opening index values are available, will it be possible to perform this test. Should opening index values be calculated in the future, a follow-up study should be conducted to determine whether the negative Monday return is a function of the non-trading weekend or trade on Monday.

Recent international research has focused on intraday trading patterns. At present such a study is not possible, as index values are only calculated at 16H00. However, if at some future stage intraday index values become available, then tests similar to those performed on international stock exchanges should be carried out on the JSE.

International research has also carried day of the week and intraday studies over to the options and futures markets. This study is unaware of any such research having been carried out on SAFEX. It is recommended that future research imitate international research on the futures market. In this manner day of the week effects on the futures market can be compared to day of the week effects on the share market[3].

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[3]SAFEX has futures contracts are based on the All Share Index, Industrial Index and Gold Index, which are referred to as the ALSI, INDI and GLDI.

5.5 Conclusion

The JSE exhibits day of the week effects in share returns. However, there does not appear to be a Weekend Effect as documented on several international stock exchanges. In fact, the JSE exhibits a Midweek Effect, with Wednesday displaying a significantly positive return. Even after adjusting returns for risk, settlement delays and dividend effects, the Midweek Effect is not eliminated.

While the Midweek Effect remains an unexplained anomaly, it does not contradict the weak form of the efficient market hypothesis. This is because once trading costs are accounted for, any potential profits are eliminated. Consequently any trading strategy based upon day of the week trading patterns will not be profitable. However, the research shows that share sales that have already been decided upon should be timed to take place on Wednesday when share prices are significantly higher than any other weekday.

APPENDIX A

Major Contributors to the All Share Index

1	De Beers	7.23%[1]	7.23%[2]
2	Anglo American	6.24%	13.47%
3	Richemont	5.17%	18.64%
4	S A Breweries	4.71%	23.35%
5	Liberty life	4.21%	27.56%
6	Gencor	3.66%	31.22%
7	Rembrant	3.60%	34.81%
8	Sasol	3.11%	37.92%
9	Stanbic	2.82%	40.74%
10	Minorco	2.77%	43.51%
11	Barlows	2.46%	45.97%
12	Engen	2.13%	48.10%
13	Rustenberg	2.13%	50.23%
14	JCI	2.09%	52.32%
15	Tiger	2.04%	54.36%
16	Driefontein	1.96%	56.32%
17	First National	1.63%	57.95%
18	Absa	1.44%	59.39%
19	Malbak	1.38%	60.77%
20	Southern	1.36%	62.14%
21	Safren	1.31%	63.45%
22	Nampak	1.26%	64.71%
23	Anglovaal Industries	1.25%	65.96%
24	Sappi	1.24%	67.20%
25	Amgold	1.20%	68.40%
26	Premier Group	1.13%	69.53%
27	Kloof	1.12%	70.65%
28	Nedcor	1.09%	71.75%
29	Freegold	1.02%	72.76%
30	Edgars	0.98%	73.74%
31	Amic	0.97%	74.72%
32	Samancor	0.96%	75.68%
33	Vaalreefs	0.93%	76.61%
34	Afrox	0.87%	77.48%
35	Pepkor	0.79%	78.27%
36	Trencor	0.77%	79.04%
37	Cons Glass	0.75%	79.79%
38	Kersaf	0.73%	80.52%
39	Impala	0.71%	81.22%
40	Foschini	0.70%	81.92%
41	Genbel	0.65%	82.57%
42	Palamin	0.63%	83.20%
43	Adcock	0.63%	83.83%
44	Amcoal	0.62%	84.45%
45	Mutual & Federal	0.61%	85.07%
46	Wooltru	0.59%	86.25%
47	Cadbury Schweppes	0.59%	86.25%
48	Pick 'n Pay	0.58%	86.83%

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[1]Weight of share in the All Share Index.

[2]Cumulative weight in the All Share Index.

APPENDIX A (Continued)

49	Western Deep	0.55%	87.38%
50	FIT	0.54%	87.92%

Major Contributors to the Industrial Index

1	S A Breweries	10.65%	10.65%
2	Richemont	8.37%	18.72%
3	Rembrandt	6.71%	25.43%
4	Sasol	5.82%	31.25%
5	Amic	4.58%	35.83%

Major Contributors to the Gold Index

1	Driefontein	20.82%	20.82%
2	Vaalreefs	14.86%	35.68%
3	Freegold	14.21%	49.89%
4	Kloof	12.85%	62.74%
5	Western Deep	9.24%	71.98%

APPENDIX B

Standard Deviations for the study where public holidays have been eliminated

DAY	NO. OBSERVATIONS	ALL SHARE	INDUSTRIAL	GOLD
Monday	360	1,3454	1,0813	2,4170
Tuesday	370	1,2106	1,0302	2,1043
Wednesday	382	1,1307	0,8222	2,3183
Thursday	375	1,0385	0,7279	2,2646
Friday	364	1,0084	0,7555	2,1220

APPENDIX C

Average returns up to 30/5/91 adjusted for settlement effects

DAY	ALL SHARE	INDUSTRIAL	GOLD
Monday	0,042956	0,024182	0,051683
Tuesday	0,034196	0,091215	-0,00918
Wednesday	0,136944	0,132972	0,102388
Thursday	0,089157	0,149589	-0,00043
Friday	0,048886	0,060534	-0,00952

Average returns after 30/5/91 adjusted for settlement effects

DAY	ALL SHARE	INDUSTRIAL	GOLD
Monday	0,029689	-0,01275	0,420016
Tuesday	0,007805	0,087952	-0,29009
Wednesday	0,048248	0,058634	0,052022
Thursday	0,129001	0,090153	0,091958
Friday	-0,02921	-0,02877	0,73952

APPENDIX D

Major Contributors to the All Share Index with their LDR days for 1993

		%	
1	De Beers	7.23[1]	FRIDAY[2]
2	Anglo American	6.24	FRIDAY
3	Richemont	5.17	FRIDAY
4	S A Breweries	4.71	FRIDAY
5	Liberty life	4.21	FRIDAY
6	Gencor	3.66	FRIDAY
7	Rembrant	3.60	FRIDAY
8	Sasol	3.11	FRIDAY
9	Stanbic	2.82	FRIDAY
10	Minorco	2.77	FRIDAY/SUNDAY[3]
11	Barlows	2.46	FRIDAY
12	Engen	2.13	FRIDAY
13	Rustenberg	2.13	FRIDAY
14	JCI	2.09	FRIDAY
15	Tiger	2.04	FRIDAY
16	Driefontein	1.96	FRIDAY
17	First National	1.63	FRIDAY
18	Absa	1.44	FRIDAY
19	Malbak	1.38	FRIDAY
20	Southern	1.36	FRIDAY
21	Safren	1.31	FRIDAY
22	Nampak	1.26	FRIDAY
23	Anglovaal Industries	1.25	FRIDAY
24	Sappi	1.24	FRIDAY
25	Amgold	1.20	FRIDAY
26	Premier Group	1.13	FRIDAY
27	Kloof	1.12	FRIDAY
28	Nedcor	1.09	FRIDAY
29	Freegold	1.02	FRIDAY
30	Edgars	0.98	FRIDAY
31	Amic	0.97	FRIDAY
32	Samancor	0.96	FRIDAY
33	Vaalreefs	0.93	FRIDAY
34	Afrox	0.87	FRIDAY
35	Pepkor	0.79	FRIDAY
36	Trencor	0.77	FRIDAY
37	Cons Glass	0.75	FRIDAY
38	Kersaf	0.73	FRIDAY
39	Impala	0.71	FRIDAY
40	Foschini	0.70	FRIDAY

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[1]Weight of share in the All Share Index.

[2]These represent the days of the week on which the shares have their LDR's.

[3]The interim LDR falls on a Sunday. For statistical procedures it will have the same impact as if the share's LDR falls on a Friday, since this is in practice the last day that the share can trade before going ex dividend.

APPENDIX E

Percentage dividend yields on the All Share, Industrial and Gold Indices

YEAR	ALL SHARE	INDUSTRIAL	GOLD
1986	4,31	3,55	5,83
1987	3,66	3,03	4,43
1988	4,89	4,11	6.02
1989	3,88	3,44	4,99
1990	3,74	3,68	4,14
1991	3,50	2,93	4,42
1992	3,39	2,58	5,30
1993	3,05	3,19	3,9
AVERAGE	3,8	3,31	4,88

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